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STATE SUPPORT AND RESEARCH

THE development of a modern laboratory, or even its operation at its normal level of activity, requires the expenditure of such large sums, that no scientific institution nowadays is in a position to meet this without financial assistance from the State. This state of affairs appears to be universal. For instance, 70% of the cost of research work done in the U.S. Universities is borne by the Federal Government, and runs up to 200 million dollars; about 50% of the student charges is also derived directly or indirectly from Government sources. In the United Kingdom, 65% of all the income of the Universities come from Parliamentary grants. In Germany, 90% of the expenditure for research is met by the State, and this is probably true also of India.

The problems raised as a result of such a predominant role of the State in the finance of scientific research were discussed at a Congress held in Hamburg in 1953, whose report has just been published.* The objectives of the Congress, according to Michael Polanyi, Chairman of the Organising Committee, were three-fold: to examine critically the organisation of scientific activity in various countries, with a view to reform and improvement; to give due and wide publicity to the nature and extent of suppression of intellectual freedom under totalitarianism; and to clarify the philosophical foundations of the idea of freedom as related to science.

* *Science and Freedom*—(Proceedings of the Hamburg Congress on Science and Freedom), Secker and Warburg, London, 1955, Pp. 292, Price: 21 *sh.*

Excluding the opening and closing sessions, the report is divided into five parts corresponding to the five sessions of the Congress which dealt respectively with: Organisation of Science, Science and the State, Science and its Method, Science in Chains, and Scientist and the Citizen.

The second session of the Congress considered in detail the problems mentioned above, namely, the political and economic framework required for the cultivation of independent scientific research in a free society. There was general agreement that the overwhelming role of the State in providing the finance for scientific research and for education in general is unavoidable. It is also obvious that even under the best set-up this would involve a certain amount of restriction of academic freedom. The discussions therefore mainly centred on the methods of reducing the centralised control to the minimum and providing the maximum freedom to the scientist and the intellectual.

It would be certainly wrong to say that science is nowadays delivered helpless into the hands of the State and its freedom destroyed, merely because it becomes dependent on the discretion of the State, exercised through its power to grant or refuse financial support. As Ludwig Raiser says, "Liberty can perfectly well be maintained in investigations supported by the State, so long as there are adequate guarantees that the State will respect the independence of the scientific domain, and of the methods of procedure appropriate to it, and will keep strictly to its role as protector and sponsor and not transgress into that of a dictator". The need for an authority constituted by the State, but composed essentially of academic people, who would be in charge of the distribution of funds for research is therefore obvious. The system adopted in England, where Parliamentary grants are administered by the University Grants Committee, was universally considered to be the ideal solution. It is indeed gratifying to note that this system has now been adopted in this country. It constitutes a relationship which presupposes mutual confidence and thus also implies the necessary freedom for both parties.

It would be appropriate to mention also another type of freedom which the academic worker must have, which was pointedly raised by Andrade. One of the results of the regimented organisation of research has been "is destroying the leisure of a professor. I would mention three words—committees, reports, correspondence. When I was young, they meant 5% of a physicist's time; now I leave it to you, gentlemen, whether it is 80%, 85%, 90% or 95%, but it is something like that.....Who is going to say in these days, 'I will keep this young man for the next ten years at leisure on the off chance that he will produce something?' But they did when I was young; perhaps once in three times they picked a dud, but the other two were the men who made advances in science".

The extent to which the State financing of research might react on the freedom of choice of subjects for research was also considered during the session. Tarski draws attention to the fact that while scientists, physicists and chemists in particular, have wide opportunities in the United States, philologists in general were at the bottom of the hierarchy until very recently they came greatly into demand with the development of the subject of mechanical translation. No solution appears to be in sight for this situation; it is bound to arise with any form of economic support. This whole issue of the material dependence of the scientist on the community is worthy of the most careful attention.

CONGRESS AND EXHIBITION AT FRANKFURT, 1955

THE Congress of the European Federation of Chemical Engineering, 1955, will take place in Frankfurt am Main from 14th to 22nd May, 1955, at the same time as the ACHEMA XI Chemical Engineering Exhibition and Congress. The Congress will be arranged in collaboration with all the member associations of the European Federation of Chemical Engineering.

More than 600 firms from 12 countries, will be presenting their new developments and established ranges of production for discussion in the Congress. Instruments for measurement and control to deal with the numerous variables of State and properties, with a degree of accuracy to meet the exacting requirements of modern science and technology, will be demonstrated by specialists from about 50 firms from 5 different countries. Individual lectures will be delivered during the afternoon and will deal with specific scientific observations and technical developments.

The ACHEMA XI Lecture Course will be organised by ACHEMA as an introduction for native and foreign students to the vast field of chemical engineering. Lectures will be held in the mornings followed by an inspection of various apparatus and machinery. The final programme for the Congress of the European Federation of Chemical Engineering will be sent to the members in due course.

Further details can be had from: Dechema, Frankfurt am Main, W-13, Germany.

AGE LEVELS OF ARCHAEAN STRUCTURAL PROVINCES

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FERMOR[1] chose the association of certain parts of Archæans with characteristic groups of sediments as a major criterion for the correlation of ancient schistose formations of Peninsular Archæans. In contradistinction to this approach, Krishnan[2] and Holmes[3,4] tried to arrive at the relative ages of the orogenies which had produced the characteristic regional strikes of the structural provinces of the Archæans (N.E.-S.W. for Aravallis, N.N.W.-S.S.E. for Dharwars, N.E.-S.W. for Eastern Ghats and E.N.E.-W.S.W. for Satpuras).

With the objective of dating the pegmatitic cycles of these provinces, detailed investigations were undertaken on five radioactive minerals drawn from various parts of Peninsular India—namely, Samarskite from Nellore (Andhra State), monazite from Mewar (Rajputana), and allanites from Madura (Madras State), Purulia (Bihar) and Anakapalle (Andhra State). Their physical and optical characters, autoradiographic pattern and chemical composition were studied to examine their suitability for purposes of age determination. While Samarskite has been found to be highly suitable,[5] allanites from Purulia and Anakapalle are fairly so but allanite from Madura[6] and monazite from Mewar are undependable as age indicators, as they have suffered leaching. The age data on the three suitable radioactive minerals determined by the lead-uranium-thorium method together with some recent Alpha-Helium and Rubidium-Strontium ages are given below:

No.	Name of the cycle	Name of the mineral dated	Locality of the mineral	Method of age determination	Age (in M.Y.)	Degree of dependability
1	Dharwar	Magnetite	Holenarsipur, Mysore	Alpha–Helium	1740	Satisfactory
2	do (?)	Phlogopite	Neyyur, Travancore	Rb–Sr	1630 ± 200[7]	do
3	Eastern Ghats	Samarskite	Nellore, Andhra	Pb–U–Th	1625 ± 75	Good
4	do	Allanite	Anakapalle, Andhra	do	1585	do
5	do	Magnetite	Mayurbhanj, Orissa	Alpha–Helium	1200	Satisfactory
6	do	do	Ongole, Andhra	do	1350	do
7	do	do	Salem, Madras	do	1350	do
8	do	Phlogopite	Visakhapatnam, Andhra	Rb–Sr	1490 ± 200[7]	do
9	Satpura	Allanite	Purulia, Bihar	Pb–U–Th	880	do
10	do	do	Bahea, Bihar	do	880[8]	do
11	do	Monazite	Pichchli, Bihar	do	970[9]	Good
12	do	Magnetite	Singhbhum, Bihar	Alpha–Helium	970	Satisfactory

In the above table, the apparent lead ages are read from the family of curves given by Wickman.[10] The ages termed "good" are dependable and those termed "satisfactory" are of the expected order of magnitude.

The Eastern Ghats cycle is given an age of $1,625 \pm 75$ M.Y. taking into consideration the magnitude of variations in the age data available. Holmes[3,4] has dated the Satpura (955 ± 40 M.Y.) and Delhi (735 ± 5 M.Y.) cycles and has recently given an age of $2,300 \pm 100$ M.Y. to the Yediyoor monazite belonging to the Dharwar cycle and $1,570 \pm 70$ M.Y. to detrital monazite from Cuttack District of Orissa (personal communication). All the four ages given above are highly dependable, being based on the isotopic analysis of lead. It therefore follows that the Eastern Ghats cycle is younger than the Dharwarian and older than those of Satpura and Delhi.

The age of the Travancore phlogopite ($1,630 \pm 200$ M.Y.) which occurs in the pyroxenite dykes is interesting. The occurrence of the mineral in the junction zone of Dharwar and Eastern Ghats strikes and the general strike of the associated charnockites and leptynites (N.N.W.-S.S.E)[11] have rendered it difficult to place the mineral in either Dharwarian or Eastern Ghats structural province. As the phlogopite from Visakhapatnam belonging to undoubted Eastern Ghats province has given an age of $1,490 \pm 200$ M.Y. and in view of the fact that the strike of the formations associated with the Travancore phlogopite is more closely related to Dharwarian rather than that of the Eastern Ghats, it is suggested that the phlogopite may belong to the Dharwar cycle.

The quartz-magnetite rocks of Ongole and Salem belong respectively to Madras-Ongole Province (No. 12) and Salem-Arcot Province (No. 11) of Fermor.[1] Both of them belong to the iron-ore province of the charnockitic region[1] and both are characterised by the Eastern Ghats trend.[2] The remarkable similarity in their Alpha-Helium ages (1,350 M.Y.), though not dependable enough for dating the Eastern Ghats cycle precisely because of the loss of helium which may occur in ancient minerals,

is capable of suggesting that the iron ores of Ongole and Salem were deposited contemporaneously.

The similarity in the age-levels of Anakapalle (1,585 M.Y.) and Nellore pegmatites (1,625 ± 75 M.Y.) which are intrusive into khondalites and mica-schists respectively constitutes additional evidence in favour of the surmise[12] that the Nellore mica belt is a continuation of the khondalitic zone. The allanite-bearing pegmatites of Anakapalle and monazite-bearing pegmatites of Cuttack (which have yielded detrital monazite) are both intrusive into khondalites of Eastern Ghats and significantly enough, the apparent lead age of the former (1,585 M.Y.) is of the same order as the Pb_{207}/Pb_{206} age (1,570 ± 70 M.Y.) of the detrital monazite (207/206 age alone is dependable in the case of detrital radioactive minerals). Thus the radioactivity age data, besides indicating the continuation of the Eastern Ghats from parts of Orissa down to Nellore and beyond, also suggests that the pegmatitic display which marks the closing stages of the Eastern Ghats orogeny is contemporaneous in the various parts of Eastern Ghats.

The conclusions drawn on the age-levels of Archæan orogenic cycles on the basis of the radioactivity age data are fully supported by the structural evidence. Krishnan[2] suggests that (i) the Dharwarian trend is a continuation of that of Aravallis; (ii) the Eastern Ghats trend is younger than the Dharwarian as it is superposed on the latter; (iii) the Satpura trend is younger than that of Eastern Ghats as is evident from their interrelationships in Gangpur State.

A tentative chronological succession of Peninsular Archæans, based on the available radioactive and structural data, is given below. Besides ages based on mass analytical data, crude ages of Satpura (885 M.Y.)[4] and Dharwar (1,850 M.Y.)[13] cycles are also given to facilitate comparison with the crude age (*ca*) of Eastern Ghats cycle:

955 ± 40 M.Y. (Ca 885 M.Y.[4])
Satpura cycle.

Ca 1,625 ± 75 M.Y.
Eastern Ghats cycle.

2,300 ± 100 M.Y. (Ca 1,850 M.Y.[13]).
Dharwar cycle (= Aravalli cycle?).

The extent of time-lag between the three cycles indicates that the succession is incomplete.

The recent advances in the field of measurement of geologic time by radioactivity methods have greatly facilitated the bringing together of the two distinct, but nevertheless, mutually related approaches, i.e., correlation of rock formations and dating of orogenic cycles, referred to at the outset. The K_{40}/A_{40}, K_{40}/Ca_{40} methods[14] of dating potassium-bearing rocks, lead method[15] for determining the ages of accessory zircons in the acid and intermediate rocks and Rb-Sr method[16] for dating accessory biotite in rocks have now made possible the estimation of the ages of the rock formations directly, thus facilitating correlation in the sense of Fermor.[1] All these methods together with the modern Pb-210 method[17] can be used to date the pegmatitic minerals and from them the orogenic cycles, in the sense of Krishnan and Holmes.[3,4] It is pointed out that the two sets of data are directly comparable as they have been arrived at by the application of similar methods. Work is in progress on these lines.

A detailed paper will be shortly published elsewhere.

The authors are grateful to Professor R. S. Krishnan and his associates for determining the Alpha-Helium ages of some of the samples sent by us, to Dr. D. N. Wadia for the specimens of allanite from Chota Nagpur and monazite from Mewar and to Mr. Ch. Leelanandam for his assistance in the analysis of radioactive minerals. The work has been sponsored by the Council of Scientific and Industrial Research.

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ACTIVE CARBON FROM SOUTH ARCOT LIGNITE

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BY virtue of its low ash content and the highly porous structure it develops on carbonisation, South Arcot Lignite provides an excellent raw material for the production of high quality active carbons.

An investigation of different methods of preparation of active carbon from lignite and a study of the adsorptive properties of the products obtained have been completed. Two main modes of activation are employed: (*a*) lignite was first carbonised into char which was subsequently activated by heating with different activating agents, and (*b*) the carbonisation and activation were conducted simultaneously in one step. In method (*a*), the char obtained by carbonising lignite at 600 ± 10° C. was mixed with 40% zinc chloride solution in different ratios (1 : 1, 1 : 2, 1 : 3 and 1 : 4) or with 40% calcium chloride solution (in ratios 1 : 2, 1 : 5 and 1 : 6), the mixed masses heated at a constant temperature (500°, 650° or 800° C.) for 2½ hours, and the adsorptive properties of the products quantitatively determined by standard methods.[4] In method (*b*) dried lignite (−80 to +100 mesh) was mixed with different amounts of zinc chloride or calcium chloride solutions as above, and heated at a constant temperature in the range 500-800° C. for 2½ hours. Another activating agent used was phosphoric acid. The acid of sp. gr. 1·75 was mixed with lignite in various ratios, the carbonisation of the mass being done at 650° C. for 2 hours. Lignite char was also activated using steam as an activating agent at different constant temperatures in the range 500-800° C. and for different durations.

The adsorptive properties of the different types of active carbons obtained by the above processes were studied by determining the adsorption of iodine[2] (in KI solution), methylene blue, oxalic acid and malachite green in aqueous solutions, by shaking different quantities of active carbon with solutions of known strengths until equilibrium was established and estimating the amounts present in solution after adsorption. Titration methods were used for iodine and oxalic acid, and colorimetric estimation with a photo-electric colorimeter[4] was adopted for the two dyes.

RESULTS

1. The unactivated char itself was found to have good adsorptive properties, the extent of adsorption increasing with the temperature of carbonisation, reaching nearly a maximum at 650° C.[3] Carbonised at this temperature, 0·1 g. of the unactivated char adsorbed 5·1 mg. of iodine, 9·1 mg. of oxalic acid, 5·2 mg. of methylene blue and 6·8 mg. of malachite green. The percentage of loss on carbonisation was 64·5.

2. In steam activation the adsorptive power increases with the temperature of activation. Here also 650° C. may be taken as the optimum temperature, the loss of material becoming excessive at higher temperatures. There is a progressive improvement in the quality of the carbon on increasing the duration of heating. It will however be uneconomic to prolong the activation beyond 2½ or 3 hours in view of the higher loss incurred.

3. Table I illustrates the relative merits of the two modes of activation (*a*) and (*b*) described above. The results generally establish the superiority of method (*b*) for all activating agents except phosphoric acid for which method (*a*) gives a carbon of slightly better quality. Phosphoric acid yields the best carbon, and the products obtained with phosphoric acid and with zinc chloride are found to be superior to the trade carbons available in the market.[6] Variation of temperature in the range 500-800° C. has little effect on zinc chloride activation. For calcium chloride, however, 650° C. was found to be the best temperature. Also, the quality of the carbon was uninfluenced by the variation of the proportions of the activating agent within the range used.

TABLE I

Adsorption by 0·1 g. of carbon activated by zinc chloride, calcium chloride or phosphoric acid

Activating Agent	Method used	Temp. of activation ° C.	Weight in milligrams adsorbed			
			Iodine	Oxalic acid	Methylene blue	Malachite green
$ZnCl_2$ ..	*a*	650	34	7	4	4
$ZnCl_2$ ..	*b*	650	11	12	25	32
$CaCl_2$ ..	*a*	650	32	6	4	4
$CaCl_2$ ..	*b*	650	98	10	16	19
H_3PO_4 ..	*a*	650	150	14	54	60
H_3PO_4 ..	*b*	650	176	12	48	56
H_3PO_4 ..	*b*	800	110	12	45	54
Steam ..	*a*	650	90	12	15	18

4. While Table I gives the adsorption data for 0·1 g. of carbon only, similar data have been obtained for weights up to 0·5 g. and also for solutions of different concentrations. Plotting[1] log x/m against log c (x = weight of solute in g. adsorbed by m g. of carbon, and c = concentration of adsorbate at equilibrium), a straight line graph is obtained in accordance with Freundlich's isotherm, with a slight deviation at low concentrations.

5. The active carbons produced in this series of experiments were found suitable for decolorising solutions of molasses, palm-gur, and cane jaggery. 50 ml. of an 8% solution of molasses[5] in a buffer of pH = 6·5 was shaken with 0·5 g. of active carbon and the percentage decolorisation measured with a photo-electric colorimeter.[4] Similar experiments were conducted with palm-gur and cane-jaggery solutions taking 500 ml. of a 13% solution for each determination. Results are shown in Table II.

TABLE II

Type of activation	Percentage colour removed		
	Molasses (i)	Palm-gur (ii)	Cane jaggery (iii)
1 None-650° C. char	26	4	2
2 $CaCl_2$–(δ)	71	15	9
3 Steam at 650° C.	73	22	15
4 $ZnCl_2$–(δ)	90	27	20
5 H_3PO_4–(α)	95	35	25
6 H_3PO_4–(δ)	92	33	23

(i) 8% solution (50 ml.) 0·5 g. of carbon; (ii) 13% solution (500 ml.) 6 g. of carbon; (iii) 13% solution (500 ml.) 6 g. of carbon.

Complete decolorisation of palm-gur solution (150 g. in 400 ml.) could be effected by using 30 g. of H_3PO_4-activated char added in 6 batches of 5 g. each, the final product being a water-white syrup. For cane-jaggery solution of the same strength as above, a total of 40 g. of carbon in 8 lots was required. These figures compare very favourably with the weights of technical grades of carbon required for complete decolorisation of these products. The spent carbon could be revived to more than 50% of the original activity, by washing and re-heating at 650° C.

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CONTROL OF NEMATODES

IN an article featuring the soil pest complex in the March issue of the *Journal of Agricultural and Food Chemistry*, a new phosphorus compound is reported to be effective for the control of the soil pests known as nematodes.

The new compound is 0-2, 4-Dichlorophenyl 0, 0-Diethyl Phosphorothioate and is available as a 75% emulsifiable concentrate.

Chemical treatment for nematode control to date, has been limited to fumigating materials, all of which are highly phytotoxic. If properly applied, all plants in treated areas are killed and therefore application must be made before planting.

The new phosphorus chemical, which was developed by Virginia-Carolina Chemical Corporation is an insoluble liquid and is applied as an emulsion. It is not phytotoxic and has been successfully applied without damage to growing turf and ornamental plants. In extensive field tests on golf greens and turf during the past four years, excellent nematode control has been achieved with 125-200 lb. per acre of the 75% emulsion. No root damage was found at higher rates of application.

The new chemical was first synthesized by Doctors William P. Boyer and J. Roger Mangham in the Richmond, Virginia, research laboratories of Virginia-Carolina, while extending investigation into the field of phosphorus compounds originally developed by Dr. Gerhard Schrader of Leverkusen, Germany. Its effectiveness as a nemacide was discovered by Dr. J. R. Christie and V. G. Perry of the Bureau of Plant Industry, U.S. Department of Agriculture, under screening programmes for possible solutions to the nematode threat.

EXCHANGE OF BIOLOGICAL PUBLICATIONS WITH CHINA

THERE are 35 natural history societies co-operating closely with The Academia Sinica, which is the Central Scientific Organisation in China, and forming a combination with other scientific societies, known as the All-China Federation of Scientific Societies (headquarters at the Academia Sinica). These societies publish 42 journals concerned with the natural sciences of which 5 are issued at Federation level.

The *Acta Academia Sinica* is a journal of general science, containing many biological papers, mostly in English, French and Russian. The papers are translations of important contributions to specialised journals printed in Chinese. Thus, the intention of the *Acta Academia Sinica* is to provide "a window on the progress of Chinese science". There are besides specialised journals in Chinese, but the papers usually have long abstracts in English or French—sometimes in Russian. The principal journals in the natural sciences are: (1) *Acta Zoologica Sinica*, (2) *Acta Entomologica Sinica*, (3) *Acta Phytotaxonomica Sinica*, (4) *Acta Botanica Sinica*, (5) *Acta Geologica Sinica*, (6) *Acta Palæontologica Sinica*, and (7) *The Chinese Journal of Experimental Biology*. There is also the monographic *Palæontologica Sinica*.

The Academia Sinica publishes annual abstracts in Chinese of foreign biological papers and reprints for the purpose are welcomed. Moreover, it hopes in the near future to publish annual volumes of classified abstracts in the principal foreign languages of scientific papers printed in Chinese; and this prospect needs encouragement.

Exchanges are welcomed and all arrangements can be made through Dr. Tsao Jih-chang, Secretary-General, Academia Sinica, Peking, China. In making new exchanges the Academy is eager to acquire back-numbers as well, so that it can have full sets as far as possible. It would be grateful, too, for information on pre-1950 numbers of most scientific journals which are available for sale or exchange, as the periodicals in most Chinese libraries were seriously neglected between 1937 and 1949. Lists of standard books published during this period and offered for sale would be equally appreciated. Dr. Hsiang Ta, Chief Librarian, Peking University, Peking, appeals for similar information.

STEPS TOWARDS SYNTHESIS OF FOODSTUFF

A GROUP of plant physiologists at the University of California, headed by Professor Daniel L. Arnon, have announced the extraction of chloroplasts intact from the green plant cells, taking their chlorophyll with them, and their use for the production of sugar from water and carbon dioxide in laboratory vessels. It was a direct chemical synthesis without the aid of the green leaf or any living part of it. It was a duplication, without life, of what only life has hitherto been able to achieve.

Success came to the California research team after they had discovered the role played by adenosine triphosphate (ATP) in the process. ATP is a compound of phosphorus, present in every living cell, and has been known for a long time as essential to the cell's nutrition.

The present discovery has revealed that ATP and the vitamins such as riboflavin and ascorbic acid also play an essential role in plant life. The use of sunlight by plants involves four steps. First, the chlorophyll absorbs the light energy from sunshine. Second, the chloroplast uses that energy to decompose water into hydrogen and oxygen. Third, the active hydrogen is taken up by the ATP. Fourth, the ATP carries the hydrogen to the carbon dioxide and uses its energy to combine the hydrogen with the carbon dioxide. The result is the formation of a simple sugar and the liberation of oxygen.

This simple explanation of how plants achieve this process also reveals why phosphates are so necessary in plant fertilizers. Without phosphate the plant cannot make ATP and this cannot grow. Furthermore, it is now clear why green vegetables are necessary in human nutrition. For their own purposes they contain the ATP and the vitamins which the human body also needs for its growth and life.

Contrary to the common impression, plants are not efficient in the use of sunlight. Less than 1% of the sun's energy which falls on a field of grass, grain or vegetables is what is actually used in producing food. All the rest is absorbed by the soil, is used in evaporating water, or is dissipated as heat. But if a synthetic food factory could use as little as 2% of the available sunshine it would represent an enormous increase in the world's food production. This is a modest goal. Five per cent. efficiency is not too much to expect. Under the circumstances, Dr. Arnon's phrase "a new era of unlimited abundance" expresses a hope that is perhaps well justified.—UNESCO.

LETTERS TO THE EDITOR

HIGH ENERGY ELECTRON SCATTERING BY BERYLLIUM

The nuclear scattering of 125 Mev electrons has been observed by Hofstadter, Fechter and McIntyre.[1] To correlate this experimental data, Schiff[2] has proposed the following one parameter functions to represent the nuclear charge density distribution:

$$\rho(r) = \rho_0 \exp(-r/a_1) \quad (1)$$

where $a_1 = 0{\cdot}74 \pm 0{\cdot}03$.

$$\rho(r) = \rho_0 [1+(r/a_2)] \exp(-r/a_2) \quad (2)$$

where $a_2 = 0{\cdot}55 \pm 0{\cdot}01$.

$$\rho(r) = \rho_0 a_3^4/[r^2+a_3^2]^2 \quad (3)$$

where $a_3 = 0{\cdot}91 \pm 0{\cdot}04$.

$$\rho(r) = \rho_0 \exp[-(r/a_4)^2] \quad (4)$$

where $a_4 = 1{\cdot}8 \pm 0{\cdot}1$.

Hofstadter *et al.*[1] have also proposed the following uniform charge contribution:

$$\left.\begin{aligned}\rho(r) &= \rho_0 \text{ for } r < R_0\\ \rho(r) &= 0 \text{ for } r > R_0\end{aligned}\right\} \quad (5)$$

where $R_0 = 2{\cdot}45$.

All the parameters given above are in units of 10^{-13} cm. Further, all the above models are equally consistent with the experimental data at 125 Mev.

Recently, McIntyre, Hahn and Hofstadter[1] have observed the nuclear scattering of 190 Mev electrons by beryllium. The relative values of the elastic differential scattering cross-sections have been measured at 60°, 70° and 90°. In the present investigation, we have used this data to discriminate between the above models by calculating the corresponding differential scattering cross-sections at the same angles for each model. Both experimental and the theoretical values have been normalised to unity at 60°. The values at other angles are given in the second and third columns of Table I.

TABLE I

Model number	Angles		Characteristic lengths	
	70°	90°	$\bar{R}_e$	$\bar{R}_c$
(1)	0·34	0·052	1·37	1·59
(2)	0·35	0·051	1·29	1·45
(3)	0·40	0·081	0·41	∞
(4)	0·32	0·037	1·23	1·29
(5)	0·33	0·035	1·18	1·18
Experimental	0·31	0·031	1·18[4]	1·20[5]

It is clear from the above comparison that only the Gaussian and the uniform density distributions can be regarded as reasonably valid. We have redetermined the optimum value for the parameter of the Gaussian function to correlate both the 125 Mev and 190 Mev data and obtained $a_4 = 1{\cdot}7$ and used this parameter in all further considerations.

The electrostatic energy for any charge distribution can be represented by a characteristic length $\bar{R}_e = R_e/A^{\frac{1}{3}}$ where R_e is the radius of a uniform distribution with the same electrostatic energy. The experimental observations on the X-rays from the μ-mesonic atoms essentialy measure the root mean square radius of the nuclear charge distribution. This introduces, for any charge distribution, another characteristic length $\bar{R}_c = R_c/A^{\frac{1}{3}}$ where R_c is the radius of a uniform charge distribution with the same root mean square radius. Using the above models, these characteristic lengths have been calculated which, along with the best experimental values are presented in the fourth and fifth columns of Table I. It is again clear from the above comparison that only the Gaussian and the uniform charge density distributions can be regarded as valid. This conclusion rectifies a previous incorrect rejection[6] of the Gaussian function where its parameter, appropriate for heavy elements, was used by oversight in calculating the electrostatic energy.

On the basis of the charge independence of nuclear forces Gombas[7] has shown that the proton and the neutron distributions do not significantly differ from each other. Thus the nucleonic density distribution may be taken to be the same as the charge density distribution. The experimental observations on the nuclear scattering of high energy nucleons do not support a uniform nuclear density distribution since different nuclear radii are required at different energies.[8] The nuclear reaction radius for protons turns out to be even larger.[9] It is hoped that all these discrepancies may be removed by adopting a non-uniform density distribution. Further, Yang[10] as well as Born and Yang[11] have shown that a reasonable correlation between the nuclear density distribution and the nuclear shell structure can be obtained by a Gaussian distribution and not by a uniform distribution. These considerations suggest that out of the suggested one-parameter family of models, the Gaussian charge density distribution is the most reasonable from the point of view of the available experimental data.

M. G. Science Inst., Navarangpura, Ahmedabad-9, October 8, 1954.

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THE VISIBLE EMISSION SPECTRUM OF Br_2^+

THE emission band spectrum of bromine in the visible region as excited by a high power high frequency oscillator, is photographed on Fuess and three prism glass littrow instruments. Photographs of the spectra extending from λ 6500 to λ 4400 revealed an extensive series of about 300 bands degraded to the red as against about 80 bands in the region λ 6700 to λ 5000 known from the earlier work of Uchida and Ota.[1] These bands may be regarded as due to the ionised molecule Br_2^+ on the analogy of

TABLE I
Isotope effect

System I						System II					
$(Br^{79}\ Br^{81})^+$		$(Br^{79}\ Br^{79})^+$		$(Br^{81}\ Br^{81})^+$		$(Br^{79}\ Br^{81})^+$		$(Br^{79}\ Br^{79})^+$		$(Br^{81}\ Br^{81})^+$	
v′	v″	cal.	obs.	cal.	obs.	v′	v″	cal.	obs.	cal.	obs.
15,	0	16·2	16	13·8	13	13,	0	13·0	13	11·3	11
16,	0	17·0	18	14·8	16	14,	0	14·0	13	12·2	11
18,	0	18·7	19	16·6	16	11,	1	8·2	8	7·1	9
19,	0	19·6	18	17·2	17	15,	1	12·4	12	10·8	12
17,	1	15·3	18	13·5	12	16,	1	13·4	12	11·7	12
18,	1	16·0	16	14·5	16	16,	2	10·9	11	9·5	11
21,	2	15·9	17	13·3	13	6,	6	9·7	13	8·4	11
21,	3	13·3	14	11·5	12	7,	8	13·3	13	11·7	13
0,	9	23·0	24	20·1	20	5,	9	17·9	17	15·5	17
6,	11	20·2	20	17·6	17	6,	10	19·1	21	16·8	14

similar bands attributed to Cl_2^+ by Elliot and Cameron.[2]

A preliminary vibrational analysis of these bands was made by Uchida and Ota on the basis of two systems. However, they admit that the v' and v'' numbering of the bands is arbitrary as the assignment of the bands is not supported by isotope effect.

In the present work the analyses of both the systems are considerably extended to include all the bands down to λ 4400. This has necessitated a renumbering of the bands and a redetermination of the vibrational constants. The new vibrational assignments of the bands are well supported by the bromine isotope effect which is well resolved for a large number of bands in both the systems. The agreement between the observed and calculated separations of the isotopic components is shown in Table I for some of the bands.

The following vibrational constants are obtained for the two systems.

	ω_e'	$x_e'\omega_e'$	ω_e''	$x_e''\omega_e''$	D_e'	D_e''	ν_e
System I	190·0	1·0	376·0	1·25	1·11	3·49	19290·0
System II	182·0	0·35	376·0	1·25	2·03	3·49	18782·0

The intensity distribution in both the systems is of the open Franck Condon parabola type which is normally to be expected for such divergent values of ω_e' and ω_e'' as above.

Full details of the analysis are being communicated to the *Indian Journal of Physics*.

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UNIT CELL AND SPACE GROUP OF TRI-PHENYL-METHANE

SOME differences were reported on the dimensions and the number of molecules in the unit cell of tri-phenyl-methane by the previous investigators.[1-3] A re-determination of the cell-dimensions and its space group was therefore undertaken.

Goniometric studies by Czapski two-circle theodolite goniometer shows that the crystal belongs to the orthorhombic hemimorphic hemihedral class $m\,m$ in accordance with the observations of Groth.[4]

Unit cell dimensions were measured by taking rotation photographs about the three axes. They were found to be $a = 14{\cdot}7$ Å; $b = 25{\cdot}6$ Å, $c = 7{\cdot}50$ Å. The axial ratios are: $a : b : c = 0{\cdot}567 : 1 : 0{\cdot}293$ which agree with goniometric ratios given by Groth[4] except that the c-axis is halved. The density of the crystal measured by flotation method was found to be 1·142 g./c.c. The number of molecules per unit cell comes out to be 8.

Oscillation photographs about the three crystallographic axes were taken and indexed by Bernal's[5] graphical method. Weissenberg photographs were taken and indexed by Wooster and Wooster[6] method.

From the indices of the reflecting planes, the following systematic absences are observed: (1) Reflections (hkl) show no systematic absence; (2) Reflections (hol) are missing when $(h + l)$ is odd; (3) Reflections (okl) are missing when k is odd; (4) Reflections (ool) are missing when l is odd.

These characteristic extinctions correspond to the space-group C_{2v}^9—$Pbn2_1$. In this description, a and b are interchanged with respect to Space Group No. 33 of the International Tables.

The number of molecules per unit cell found experimentally is 8 whereas the number of molecules required by this space-group is 4. Cases of this type, though rare, are known.[8] Such results can only be explained on the assumption that the asymmetric units are polymers of molecules and not single molecules themselves. Thus it appears that the two molecules of tri-phenyl-methane polymerize in some way to form one asymmetric unit of the elementary unit cell as was first suggested by Mata Prasad.[3]

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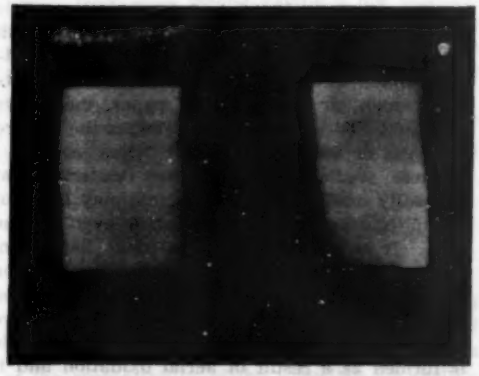
EFFECT OF LEATHERS AND TANNAGES ON THE PHOTOGRAPHIC PLATE

As has already been reported by one of the authors,[1] substances like wood are endowed with the property of acting on a photographic plate even in the dark and imprinting on it an image. This phenomenon is known as the Russel Effect. A study of this phenomenon has now been undertaken in leathers of different tannages.

For the purpose of this experiment, cut portions from the butt of a heavy buffalo hide and a light cow hide were soaked, limed, unhaired and delimed according to the customary processes. The pelt so obtained was dehydrated in different changes of acetone and the perfectly white dehydrated pelt was kept as a stock sample. Cut portions of this dehydrated pelt were then tanned with different tanning materials: (1) 33% basic chrome sulphate, (2) 33% basic aluminium chloride, (3) 33% basic aluminium sulphate, (4) Wattle Tannin Extract, (5) 30% formaldehyde, (6) benzo-quinone, and (7) Divi-divi tanliquor.

The material was kept in contact with the tanliquors for a period of seven days with intermittent agitation. The tanned materials were washed free of the excess tanning material with distilled water and the materials dried. The tanned samples were then placed in contact with the photographic plates in total darkness and allowed to remain thereon for 48 hr. Details of the experiments have already been described in the previous notes quoted above. The plates used in the above experiment were Ilford Zenith Supersensitive Plates, having a speed of 700 H & D and a range of spectral sensitivity 2,300-5,200 Å. This plate has been found to be most suitable for all Russel Effect work. The plates were developed for 7 minutes at 75° F. using I-D-2 developer at tank strength.[2]



Thick Buffalo hide Light Cow hide
(Wattle-tanned)

An examination of the plates revealed that: (1) the dehydrated pelt which is a purely collagenous material does not give a picture; (2) the pelt treated with vegetable tanning materials like wattle, divi-divi, and benzo-quinone, gives very dense pictures; (3) the mineral tanning agents like aluminium, and chrome and also formaldehyde do not impart to the pelt the property of acting on a plate in the dark; (4) the thicker pelt from the buffalo, when tanned with vegetable tanning materials, gives a denser picture as compared to the thin material from the cow; (5) the action is exerted, as in the case of wood, through the pores of a filter-paper and through air. Even the fairly thick black paper used as wrappings for the photographic materials is unable to stop this action completely; (6) as in the case of wood, sunlight has the distinct effect of invigorating this phenomenon.

From the above observations, the following comments may be made:

(1) The protein as such does not have the property of giving a picture in the dark; but when impregnated with materials like vegetable tannin extracts or quinone which are readily oxidisable and reducible, it becomes photographically active. This is further confirmed by the fact that pelt tanned with other substances like basic chrome or aluminium salts does not show the effect; (2) with increase in thickness of the pelt, there is an increase in the density of the picture. This is probably due to the greater amount of oxidisable and reducible substances fixed with the thicker pelt as compared to the thinner one; (3) of the three easily oxidisable and reducible materials used for tanning—wattle, divi-divi, and quinone—quinone is found to be most active. This is shown by the denser pictures obtained with quinone compared to those of wattle and divi-divi tanned leathers; (4) as the action is exerted through air and pores of paper, the active substance or substances must be in the nature of a gas or vapour.

These studies show that any material that is readily oxidisable and reducible may have an action on the photographic plate even in the dark. It is probable that materials like rosin, tannin, etc., present in the wood, may be the root cause of the activity exhibited by wood samples. These studies, however, do not give any positive evidence that hydrogen peroxide is formed as a result of aerial oxidation and it is this that is responsible for the fogging of the photographic plate. Russel's peroxide theory,[3] therefore, still awaits confirmation by more conclusive experiments.

The photograph below is a positive print of the pictures obtained by a heavy buffalo hide and a light cow hide tanned with wattle tannin extract.

Further studies are in progress. Details will be published elsewhere.

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SPECTROPHOTOMETRIC STUDY OF FERRIC DIMETHYLGLYOXIME COMPLEX

It is well known that dimethylglyoxime forms complexes with various metallic ions.[1-4] The ferrous iron complex[5] with dimethylglyoxime gives in an ammoniacal solution a characteristic pink colour which is measured at maximum absorbancy. The presence of dimethylglyoxime prevents the precipitation of ferric salts as hydroxide even at high pH. This indicates the formation of a ferric complex, which is studied spectrophotometrically using a Beckman DU Spectrophotometer with a matched 1 cm. silica cell. Chemicals used in these experiments are E. Merck Guaranteed or B.D.H. Analar Reagents.

Dimethylglyoxime in alcohol shows a continuous absorption in the ultraviolet region [Fig. 1 (A)]. Ferric chloride in aqueous solu-

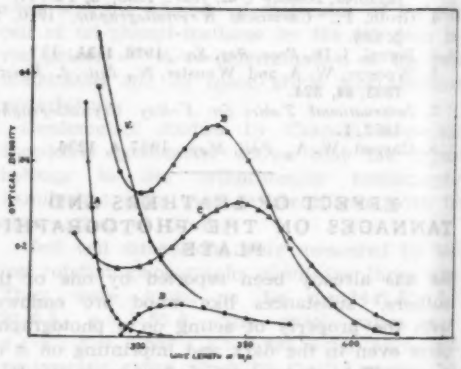

FIG. 1.

A—Dimethylglyoxime in alcohol 0·025% solution.
B—Ferric chloride in water 0·055 mg. of Fe_2O_3/ml.
C—Ferric chloride in alcohol 0·011 mg. of Fe_2O_3/ml.
D—Ferric chloride (0·0022 mg. of Fe_2O_3/ml.) and dimethylglyoxime (4·0 mg./ml.) in alcohol pH 10·4.
E—Ferrous dimethylglyoxime complex in ammonia C_{Fe} 0·0044 mg. Fe_2O_3/ml.

tion shows an absorption maximum at 335 mμ which shifts to 345 mμ on addition of alcohol [Fig. 1 (B, C)]. The colour of the alcoholic solution is deeper and the optical density greater than that of the aqueous solution. The absorption curves obtained with ferric chloride to which different amounts of dimethylglyoxime have been added are identical with the curve for alcoholic solution of ferric chloride.

However, an absorption maximum is obtained for the ferric dimethylglyoxime complex in

an ammoniacal medium. The absorption curve is measured with 1 ml. of ferric chloride solution (containing 0·055 mg. Fe_2O_3 per ml.), 10 ml. of 1% solution of dimethylglyoxime, 2 ml. of ammonium hydroxide (pH 11) and ethyl alcohol to make up the volume to 25 ml., and a maximum is obtained at 320 mμ [Fig. 1 (D)]. To confirm that this maximum is not due to the ferrous complex, the absorption curve for ferrous was also taken [Fig. 1 (E)]. It is clear that the maximum at 320 mμ is indicative of the formation of the ferric dimethylglyoxime complex. The necessity of addition of large excess of dimethylglyoxime in order to keep ferric salt in solution in ammoniacal medium is presumably due to the demands of the law of mass action. Without a sufficient excess of dimethylglyoxime the extent of complex formation would not be sufficient to prevent the precipitation of ferric hydroxide. The Beer's Law curve is shown in Fig. 2. The

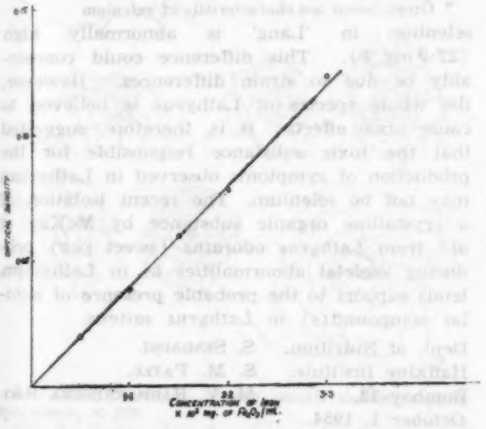

FIG. 2. X mg. of Fe^{+++} added to dimethylglyoxime (4·0 mg./ml.) in alcohol and pH adjusted to 10·4.

authors wish to thank Dr. J. Shankar and Dr. V. T. Athavale for their kind interest.

Chemistry Division, Atomic Energy Establishment, Bombay, *January* 28, 1955.

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DIAMAGNETIC SUSCEPTIBILITY OF THE TUNGSTATE ION

THE study of the diamagnetic susceptibility of some metallic tungstates and the tungstic acid was undertaken and from these results the susceptibility of the tungstate ion was calculated, as no work has been done so far in that direction. The substances studied were: tungstates of sodium, calcium, barium and lead and also tungstic acid.

Measurements of susceptibilities were made with a Curie balance. Water was used as the standard for comparison, its susceptibility at room temperature being taken to be $-\cdot72 \times 10^{-6}$. The containers were thin spherical bulbs blown from glass tubing having a low diamagnetic susceptibility. The retorsion method was employed, the specimen being brought to the identical position in presence of the magnetic field.

The susceptibilities of the metallic ions[1-3] used in calculating the susceptibility of the tungstate ion are given in Table I.

TABLE I

Ion	Na^+	Ca^{++}	Ba^{++}	Pb^{++}
$-\chi 10^6$	6·9	7·0	25·4	30·1

The results regarding the susceptibilities of the various tungstates investigated (mean of 5 determinations in each case) and the values of the susceptibility of the tungstate ion deduced therefrom are given in Table II. The mean

TABLE II

Substance	Mol. wt.	$-\chi \times 10^6$	$-\chi_M \times 10^6$	$-\chi \times 10^6$ of WO_4
$Na_2WO_4.2H_2O$	329·95	·203	66·9	27·2
$CaWO_4$	288·00	·126	36·4	29·4
$PbWO_4$	455·13	·133	60·6	30·5
$BaWO_4$	385·28	·142	54·8	29·4
H_2WO_4	249·94	·112	28·0	28·0

diamagnetic susceptibility of the tungstate ion is calculated from these to be 28·9. Weiss[4] pointed out the necessity of taking into account the ionic paramagnetic contribution of H as 1·00. If this is taken into account in the case of tungstic acid, the tungstate ionic susceptibility becomes 30·0. But in the present calcu-

lation, the ionic contribution of hydrogen, as is generally assumed, is taken to be zero.

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SELENIUM CONTENT OF 'KHESARI' (*LATHYRUS SATIVUS*) AND OTHER PULSES

LATHYRISM in man, in which spastic paralysis of the lower limbs is a marked feature, has been described in certain areas in India where *Lathyrus sativus*, which is often called 'Khesari' or 'Lang', is consumed over long periods. Rudra[1] has reported a high content of selenium (22·9 mgm.%) in 'Lang' as responsible for the neurotoxic effects. He has further suggested that selenium interferes in the utilization of sulphur and thus, with the metabolism of thiamine, biotin and methionine. 'Lang' is still raised as one of the main crops in some parts of Bombay State and its disposal has received considerable attention recently. In view of this, it was thought interesting to examine the varieties of locally available 'Lang', as also other commonly consumed pulses for their selenium content.

The selenium in the samples was estimated by the Davidson's wet combustion method.[2] The blue colour developed 2 hours after addition of 3% codeine sulphate solution, in an aliquot of the test acid digest was measured in the Unicam Photo-electric Colorimeter, using Filter No. 204. The values of selenium in test solutions were read from the standard curve, obtained by using different concentrations of selenium. Reliability of the method was checked by running few recovery tests by adding known amounts of selenium to the unknown sample. Selenium contents of the different samples analysed are given in the following table.

The results given above clearly indicate absence of any significant difference in the selenium content of 'Lang' and other commonly consumed pulses and a sample of imported 'milo'. Selenium was also estimated in 'Lang dal' and husk separately. The figures show that it is fairly equally distributed between the two on percentage basis. We are unable to confirm Rudra's[1] finding that the amount of selenium in 'Lang' is abnormally high (22·9 mg.%). This difference could conceivably be due to strain differences. However, the whole species of Lathyrus is believed to cause toxic effects. It is, therefore, suggested that the toxic substance responsible for the production of symptoms observed in Lathyrism may not be selenium. The recent isolation of a crystalline organic substance by McKay *et al.*[3] from *Lathyrus odoratus* (sweet pea) producing skeletal abnormalities as in Lathyrism, lends support to the probable presence of similar compound(s) in *Lathyrus sativus*.

TABLE I

No.	Local name	Botanical name	Selenium mg./100 g.
1	'Lang', (big variety, with husk)	*Lathyrus sativus*	1·8
2	'Lang', (big variety, without husk)	do	1·0
3	'Lang', husk, (big variety)	do	1·4
4	'Lang', (small variety, with husk)	do	1·4
5	'Lang', (small variety, without husk)	do	1·5
6	'Lang', husk, (small variety)	do	1·6
7	'Lang dal'	do	1·5
8	'Chana' (Bengal gram)	*Cicer arietinum*	1·9
9	'Tur dal' (Pigeon pea)	*Cajanus indicus*	1·6
10	'Masoor', (Lentil)	*Lens esculenta*	1·5
11	'Moog', (Green gram)	*Phaseolus radiatus*	0·4*
12	'Watana', (Peas)	*Pisum sativum*	0·9*
13	'Kulid', (Horse gram)	*Dolichos biflorus*	*
14	'Milo'	*Sorghum vulgare*	1·9

* Green colour not characteristic of selenium

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SEPTATE EPIDERMIS AND STOMATA IN THE TENDRIL OF *VITIS PALLIDA* W. & A.

ONE of us has already reported the occurrence of septate epidermal cells in the tendril of *Vitis repens*.[1] Figs. 1 and 2 show the septate epidermal cells in the terminal region of the tendril of *Vitis pallida*. A single epidermal cell is divided by anticlinal, periclinal or

oblique thin-walled septa. A similar condition is also observed in the middle curved region of the tendril.

The stomata are raised above the level of the epidermal surface. Each stoma consists of a pair of guard-cells, associated with a number of subsidiary cells (Fig. 3). Figs. 4-7 show some of the developmental stages. The guard-cells in surface view appear kidney-shaped with ledges of wall material on the upper and lower sides. The outer ledge has a layer of cuticle extending for a short distance into the stomatal aperture (Fig. 3). Both the ledges appear horn-like in cross-section. Occasionally there is a variation in the usual shape of the guard-cells (Fig. 8). The subsidiary cells, all round the guard-cells, are easily distinguishable in size, shape and form from those of the adjacent epidermis (Figs. 8 and 9). Some of them are parallel to the long axis of the pore and guard-cells (Figs. 7 and 9).

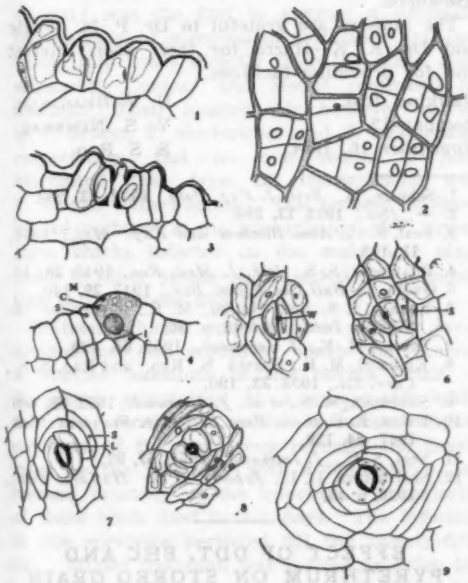

FIG. 1. Transection of the tendril showing septate epidermis, × 225.
FIG. 2. Surface view of septate epidermis, × 165.
FIG. 3. Transection of the tendril showing epidermis with stoma. Outer and inner ledges in solid black, ×375.
FIGS. 4 to 7. Developmental stages of a stoma in transection and surface views, × 225. M-mother cell; C-chloroplast; S-subsidiary cell; I-intercellular space; W-swollen intercellular substance; L-ledges.
FIG. 8. Stoma with guard-cells of unusual shape in surface view, × 225.
FIG. 9. Stoma of leaf in surface view; ledges in solid black; chloroplasts dotted, × 225.

According to Metcalfe and Chalk,[2] the stomata of the *Ampelidaceæ* (Vitaceæ) are ranunculaceous in the few species examined. In *Vitis pallida* they appear to be of the rubiaceous, paracytic type or C type of Metcalfe and Chalk.

We are grateful to Prof. P. Maheshwari for his interest in the work.

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ANTIGENIC ANALYSIS OF PASTEURELLA

SCHUTZE[1,2] postulated the presence of two antigens in the plague bacillus, one contained in the 'envelope' and the other in the 'soma' of the bacillus. He showed that the envelope antigen was thermolabile and was responsible for the production of protective antibodies in animals. The somatic antigen was heat-stable and was found to have much in common with *P. pseudo-tuberculosis*. These results have been confirmed by Seal.[3]

Common antigens between *P. pestis* and *P. pseudo-tuberculosis* have been determined by previous workers using precipitin and agglutination techniques.[1-4] But these techniques suffer from the disadvantage that it is difficult to detect the presence of more than one common antigen. With the development of the gel diffusion technique by Oudin[5] the problem was studied afresh to determine the number of antigens present in the supernatant plague (strain 195/P), and pseudo-tuberculosis (PRI) vaccines. This technique was also used to find out the number of common antigens between *P. pestis* and *P. pseudo-tuberculosis* and other protective avirulent strains of *P. pestis* like TJS (Tjiwidej) and EV (Madagascar) and non-protective avirulent strains of *P. pestis*, like TRU and NC (a non-capsulated variant isolated by J. P. Menezes).

The vaccines from all these strains were prepared by the procedure adopted in Haffkine Institute for the routine production of plague vaccine described by Sokhey and Habbu.[6] The antisera were prepared by repeated subcutaneous and intravenous injections of the cultures killed with 0·07% formalin and preserved with 1·5 mg.% of phenyl mercuric nitrate.

The gel diffusion technique used in our laboratories is a slight modification of Bowen's[7]

procedure, and has been described by Kulkarni, Rao and Rao.[8] The results are summarised in Table I.

TABLE I

Results of Oudin's gel diffusion technique with different strains of Pasteurella

Antigen	Antiserum	Antigen-Antibody precipitin lines	
		intense	faint
195/P Vaccine	195/P	3	4
PRI Vaccine	PRI	2	4
PRI Vaccine	195/P	1	3
195/P Vaccine boiled for 1 hr.	195/P	1	1
195/P Vaccine boiled for 1 hr.	PRI	1	..
TRU Vaccine	195/P	3	4
TJS Vaccine	195/P	3	4
EV Vaccine	195/P	2	4
NC Vaccine	195/P	2	4

It is evident from Table I that *P. pestis* contains three soluble antigens in larger proportion and at least four in smaller amounts. Using Oudin's technique, Silverman *et al.*[9] obtained only three broad zones with the soluble fraction of *P. pestis*. It is also evident from Table I that *P. pestis* has one antigen in large proportion and at least three in lesser amounts in common with *P. pseudo-tuberculosis*. It is observed that the heat-stable antigen of *P. pestis* is the common antigen between *P. pestis* and *P. pseudo-tuberculosis*.

The electrophoretic analysis of the concentrated plague supernatant was also carried out in a Hilger electrophoresis apparatus at pH 8·6 in barbiturate buffer of 0·1 ionic strength. The ascending patterns were photographed from time to time (Fig. 1). It is seen from Fig. 1, that there are three peaks indicating the presence of three components.

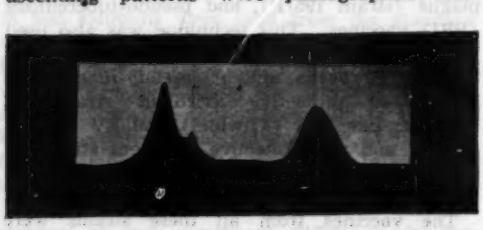

FIG. 1. Electrophoresis of Plague Supernate Time of exposure: 180 mts. Field Strength: 4·1 volts/cm.

Attempts are in progress to isolate and purify the antigens of plague using Oudin's test[5] as a criterion of the purity of the fractions. The plague vaccine was fractionated with ammonium sulphate according to the procedure of Baker *et al.*[10] Each of the fractions contained 3-4 antigens. Seal[11] and Shrivastava[12] have used sodium sulphate for fractionation. In our further attempts to purify the protective antigens, we have obtained encouraging results by extracting the lyophilised antigens with solvents like ethylene glycol and diethylene glycol, and fractionating these extracts with acetone. The results of these experiments will be reported elsewhere.

The authors are grateful to Dr. P. M. Wagle and Dr. A. K. Hazra for their keen interest and for providing facilities.

Haffkine Inst., Bombay-12, *November* 16, 1954.

N. V. BHAGAVAN.
Y. S. NIMBKAR.
S. S. RAO.

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EFFECT OF DDT, BHC AND PYRETHRUM ON STORED GRAIN

A SERIES of tests were conducted in the Entomological Division of the Institute during 1952-53 with 10 per cent. DDT, 0·5 per cent. γ-BHC and 0·2 per cent. Pyrethrin dusts with five different seeds, *viz.*, (1) Wheat Np 165, (2) Gram Np 58, (3) Barley Np 13, (4) Maize yellow 2, and (5) Rahar mixed. The concentrations were: 2 oz. per 125 lb. of grain for DDT, 2 and 4 oz. for 125 lb. of grain for BHC, and 2 oz. for 125 lb. of grain for pyrethrum. The treated grains were kept under normal conditions of storage, from harvest to sowing time.

Observations made so far show that regarding pest infestation and viability, wheat gives highly significant results with all the four treatments. Significant results have also been obtained in the case of gram as regards freedom from insect infestation, with BHC and pyrethrum treatments. In the remaining three grains,

viz., barley, maize and rahar, although the results do not give the same significant difference, either for viability or for infestation, the trend however, unmistakably shows that the treatments are satisfactory.

Indian Agric. Res. Inst., P. B. MOOKHERJEE.
New Delhi, *November* 14, 1954.

TRANSMISSION OF *TRYPANOSOMA EVANSI* STEEL, 1885 FROM MAMMALS TO FOWLS

GOEBEL[1] was the first to attempt a successful transmission of mammalian pathogenic trypanosomes into fowls directly from the hosts. Subsequently, Corson[2] and Hood[3] confirmed his findings. Their experiments however related to *T. brucei*, *T. rhodesiense* and *T. equiperdum* respectively. But no one seems to have attempted this type of transmission with *T. evansi* with success. The success achieved by the authors[4] in the transmission of *T. evansi* from chicks infected in the embryonic stage itself to other young chicks acted as an incentive to undertake this trial.

Sixteen chicks experimented upon were divided into two groups of which one received a heavier inoculum of the bovine strain of *T. evansi* maintained in a guinea-pig, while the other received a milder inoculum. Eighty per cent. of the first group revealed the flagellates by the fifth day with a tendency to increased intensity of the infection. A majority of these birds died in 2-3 days. The infection in the survivals persisted till the twenty-fifth day. Milder inoculum was noticed to delay the incubation period, the trypanosomes appearing on the tenth day only. Only 40% of this group were found infected and none of them died. Besides, the trypanosomes were not found to increase in number in contrast to the other group. Herein also the protozoa persisted till the twenty-fifth day.

Microscopical detection of the trypanosomes in the peripheral blood of the infected birds was an important finding, besides the successful direct transmission of *T. evansi*. Goebel, Corson and Hood could record their success only by biological tests. They could not see the flagellate in the peripheral blood under a microscope in any infected bird. Tenderie[5] too detected the infection in the fowl exposed to the bites of *Glossina palpalis* harbouring *T. brucei* by biological test only. Further, the death of the majority of the infected chicks within a few days, after revealing the organisms in blood is in sharp contrast to the observation made by us on the chicks infected during the embryonic stage. This is a pointer to a possible adaptability and lessening of virulence of *T. evansi* to avian species when the infection is given during the embryonic stage.

In conclusion, we wish to record three important observations made for the first time, *viz.*, (1) the possibility of successful direct transmission of *T. evansi* from mammals to fowls; (2) possibility of observing *T. evansi* under a microscope in the peripheral blood of such infected birds; and (3) possible adaptability and lowering of virulence of *T. evansi* to the avian host when cultivation is made during the embryonic stage of its development.

Dept. of Parasitology, V. S. ALWAR.
Madras Vet. College, G. RAMANUJACHARI.
Madras-7, *December* 2, 1954.

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UNUSUAL LOWERING OF SALINITY IN THE MADRAS COASTAL AREA AND ITS EFFECT ON THE PLANKTON

THE salinity of the Madras coastal waters is usually about 25 parts per thousand towards the end of October when the N.E. Monsoon sets in and increases to 33 in March and 35 in the summer months (Ramamurthy[1]). This year, however, the salinity fell to 19·45* on the 27th of October, from 34·24 in the beginning of the month. The sudden and considerable diminution of the salinity is unprecedented and so the features of the inshore plankton studied from 39 samples, collected from September 1 to November 15, are presented here.

As can be seen from the graph the drop in salinity from October 4th to 27th cannot be entirely related to the local rainfall on which depended the opening of the sand bars blocking the rivers Cooum and Adyar about the 20th of October. The salinity fell to about 22 before these local events took place. The dilution is therefore due to the currents from the northern part of

* Numbers relating to salinity are in parts per thousand.

the bay being conveyed to the south by the N.E. Monsoon winds (Sewell[2]). This is supported by the fact that on October 13 the surface water in the off-shore area had a salinity of 22·64 as in the inshore, but at a depth of 20 fathoms it was as high as 31·24, suggesting the southward flow of a large bulk of water of low salinity over the surface of water of higher salinity.

The volume of plankton increased considerably (see graph) about the third week of October when the salinity was approaching the minimum. This increase in volume was due to the diatom bloom induced by the rainfall rather than the lowering of salinity, for there was a similar flowering of diatoms in September when there were local rains and the salinity was 34.

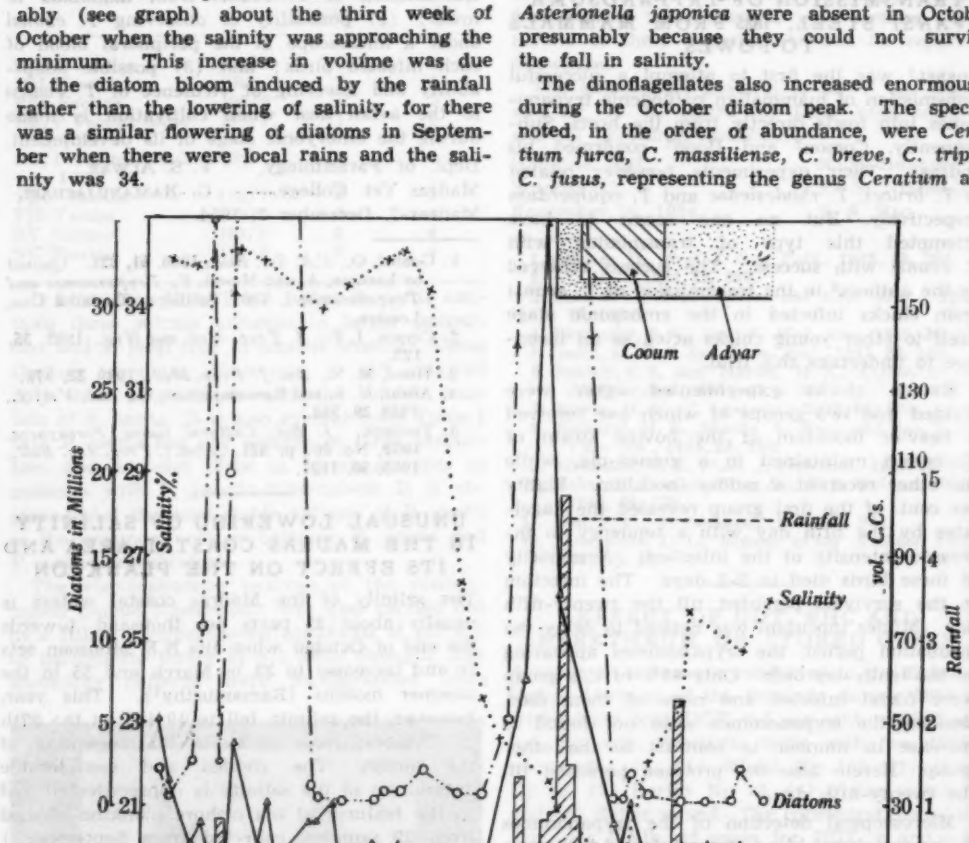

Figure showing the fluctuations in salinity, plankton volume, diatoms and rainfall. The periods during which the mouths of the two rivers Cooum and Adyar remained open are represented at the top.

Comparing the phytoplankton obtained in September when the salinity was 34 and in October when the salinity was 20, we do not find much difference in the composition of the population. In the order of their concentration the diatoms were in September as follows:— *Thallasiosira*, *Nitzschia*, *Asterionella*, *Chætoceras*, *Thallasiothrix*, *Bacteriastrum*, *Coscinodiscus*, *Rhizosolenia*, *Pleurosigma* and *Biddulphia*. In October they were *Chætoceras*, *Bacteriastrum*, *Rhizosolenia*, *Lauderia*, *Conscinodiscus*, *Hemidiscus*, *Thallasiothrix*, *Dityium*, *Pleurosigma*, *Bacillaria* and *Skeletonema*. This lends support to Allen's[3] view that the diatoms can tolerate lower salinity conditions than those that are obtained normally. However, *Thallasiosira* sp., *Nitzschia closterium* and *Asterionella japonica* were absent in October presumably because they could not survive the fall in salinity.

The dinoflagellates also increased enormously during the October diatom peak. The species noted, in the order of abundance, were *Ceratium furca*, *C. massiliense*, *C. breve*, *C. tripos*, *C. fusus*, representing the genus *Ceratium* and *P. depressum* and *P. ovatum* representing the genus *Peridinium*. All the species appear to be euryhaline as they are recorded from high salinity waters normally.

Trichodesmium occurred in swarms when the salinity ranged from 20-25. From the records of Menon,[4] Menon[5] and Chacko[6] it appears that

Trichodesmium flourishes better in waters of low salinity.

Among the copepods *Acrocalanus longicornis, Paracalanus parvus, Oithona rigida, Corycæus* sp., *Eucalanus elongatus, E. crassus* and *Acartia erythræa* occurred in October in as large numbers as in September. However, *Euterpina acutifrons* appeared in smaller numbers in October and *Clytemnestra rostrata* almost disappeared during the period of low salinity.

Appendicularians represented by *Oikopleura* and *Frittilaria*, and the Hydromedusæ by *Obelia* sp. and *Liriope tetraphylla*, and Cladocerans by *Evadne tergestina* did not show any numerical depression in October.

Lucifer sp. which was common in September almost disappeared when the salinity fell in October. This is perhaps a stenohaline species.

Sagitta enflata, abundant in September, declined in October. But it was found that their decline coincided with the diatom increase. Since *S. enflata* once again appeared in fair numbers when the diatoms subsided it is possible that this arrow-worm avoids diatom patches and also does not tolerate as low a salinity as 20.

Siphonophores occurred irregularly till the end of October after which they appeared in good numbers. The occurrence of members (*Lensia subtiloides* and *Diphyes chamissonis*), of this predominantly oceanic group in large numbers on the 27th when the salinity was lowest is remarkable.

Larvæ of Polychætes, Gastropods, Lamellibranchs, Cirripedes, Copepods, Echinoids as well as young Pteropods (*Cresis acicula*) were as common in October as they were in September.

It can be concluded that a rapid lowering of salinity by 15 parts per thousand has not affected the composition of the inshore plankton to any marked extent. It is probable that the inshore surface forms are highly euryhaline.

Thanks are due to Professor C. P. Gnanamuthu, for guidance and encouragement.

University Zoology Res. Lab., Madras, *December* 1, 1954. M. S. Muthu.

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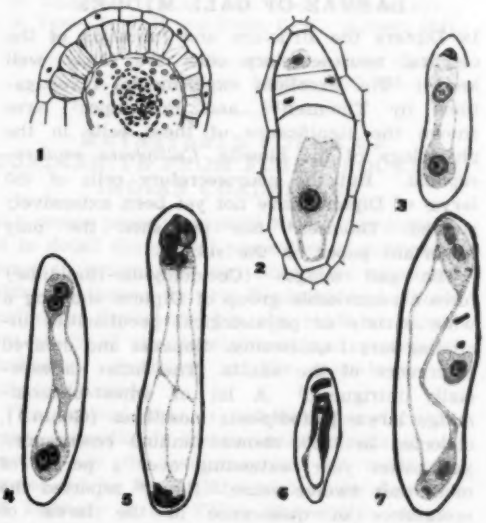
FLORAL MORPHOLOGY OF *TERMINALIA BELERICA* ROXB.

Terminalia belerica belongs to the family Combretaceæ. The present note deals with microsporogenesis, megasporogenesis and development of megagametophyte in this species.

The wall of the anther consists of four or five layers of cells in addition to epidermis; the outermost of these forms a fibrous endothecium. The microspore mother cells undergo meiosis, and the resulting microspores usually show a tetrahedral, but occasionally an isobilateral arrangement. In some anthers degeneration of microspores has been observed (Fig. 1).



FIGS. 1–7

Fig. 1. Anther lobe showing the epidermis, fibrous endothecium and the degenerating microspores, × 70. Fig. 2. A linear tetrad, × 320. Fig. 3. Two-nucleate megagametophyte, × 160. Fig. 4. Four-nucleate megagametophyte, × 160. Fig. 5. Mature megagametophyte, × 160. Fig. 6. Degenerating megagametophyte, × 160. Fig. 7. Two megagametophytes in a single ovule, × 160.

The ovary is inferior, unilocular and usually contains two ovules which are bitegmic, crassinucellate and anatropous. Only one of the ovules develops into a seed; the rest degenerate and are crushed by the developing seed. The ovary is provided with unicellular hairs which are the modified epidermal cells.

There is a multicellular archesporium in the ovule, but usually only one archesporial cell develops further. Occasionally, two or more archesporial cells develop. Megasporogenesis proceeds normally and the arrangement of the megaspore tetrad is usually linear (Fig. 2).

The development of megagametophyte corresponds to Polygonum type. The antipodals degenerate early (Figs. 3, 4, 5). At certain stages of megagametophyte development, the nuclei of the gametophyte were found to disintegrate (Fig. 6). In a few cases two or more megagametophytes have been noticed in a single ovule (Fig. 7).

My sincere thanks are due to Prof. L. N. Rao for kind encouragement.

Dept. of Botany, M. NAGARAJ.
Central College, Bangalore,
December 10, 1954.

NEUROSECRETORY CELLS IN THE LARVAE OF GALL MIDGES

IN Diptera the structure and functions of the cerebral neurosecretory cells are fairly well known. The excellent experimental investigations by Thomsen[1,2] and Possompes[3] have shown the significance of these cells in the physiology of the blowfly, *Calliphora erythrocephala*. But the neurosecretory cells of the larvæ of Diptera have not yet been extensively studied. Thomsen[4] has published the only important paper on the subject.

The gall midges (Cecidomyidæ-Itonididæ) form a remarkable group of Diptera showing a wide variety of physiological peculiarities including larval quiescence, diapause and delayed emergence of the adults. The latter is especially intriguing.[5] A lot of wheat-blossom-midge larvæ [*Sitodiplosis mosellana* (Gehin.)], collected in 1939, showed annual emergences, year after year, extending over a period of more than twelve years. Nayar[6] reported the occurrence of quiescence in the larvæ of *Schizomyia macarangæ* Nayar, which could be broken by contact of water. A similar condition has recently been observed in the larvæ of *Contarinia sorghicola* (Coq.) by Passlow.[7]

To understand the nature of the neurosecretory cells of the larvæ, the last instar stages were removed from the galls and the entire anterior half of the body or the central nervous systems dissected out, were fixed in Bouin's fluid, Allen's modification of the same or sodium chloride-formalin (10%) and sectioned at 5 or 7 μ. They were mostly stained in Gomori's chrome-hæmatoxylin-phloxin; some were stained rapidly in Groat's hæmatoxylin. *Lasioptera falcata* Felt., *Schizomyia macarangæ* Nayar and *Dasyneura brassicæ* (Winn.) were used for study. Live tissues were examined from the larvæ of *Lasioptera falcata* Felt. under the phase contrast microscope.

The brain shows the neurosecretory cells clustered together in the mid-region of the pars intercerebralis. These cells are large, and conspicuous, with prominent vesicular nuclei and rounded nucleoli. The crowding of these cells in the brain presents the appearance of a coalesced cluster. In simple staining with Groat's hæmatoxylin the cytoplasm appears blackish-blue; but in chrome-hæmatoxylin-phloxin it takes up phloxin also, and so looks bluish-red or red. The nucleoli are truly phloxinophil. Similar cells are seen scattered in the subœsophageal ganglion and as a cluster posteriorly in the ventral nerve cord.

The nervous system freshly dissected out in insect-Ringer and cleared from adjoining fat tissue, when examined under the microscope, shows tiny but conspicuous neurosecretory cells measuring from 6·15-10·1 μ and averaging about 8·58 μ in diameter. These cells are more than double the size of the other neurones in the brain. The cytoplasm shows under the phase contrast microscope, the secretory products composed of dark granules and vacuole-like bodies. The vacuoles vary in size and are of two distinct types; a set of small ones with black rims and clear interior—the spheroids—and a set of larger ones, transparent, with clear rims and tending to coalesce to form comparatively large droplets (Fig. 1). The latter shows granules within them. The picture resembles that given by Thomsen[4] in his Fig. 23 for *Tabanus* sp.

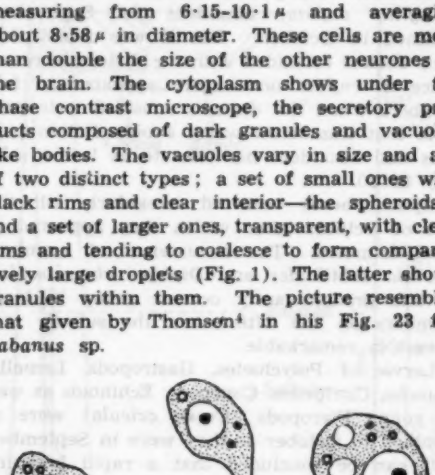


FIG. 1. Camera lucida drawing of four neurosecretory cells of the brain of the last instar larva of *Lasioptera falcata* Felt. seen under phase contrast microscope. The tiny granules in the cytoplasm are shown by stippling.

A: axon; N: nucleus with nucleolus; S: spheroid; V: vacuole.

The cells are well defined in the last instar larvæ. The histological changes in pupation and the histo-physiological nature of these in

diapausing larvæ and in their pupation are under investigation.

My thanks are due to Prof. Math. Thomsen and Dr. E. Thomsen for their hospitality and help during my stay in Copenhagen, where the work was started in August 1953, to Prof. K. Bhaskaran Nair, for facilities provided and to Miss B. M. Stokes, Rothamsted Experimental Station, England, for the larvæ of *Dasyneura brassicæ* (Winn.) used in this study.

Dept. of Zoology, K. K. NAYAR.
University College,
Trivandrum, *December* 6, 1954.

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ANATOMY AND MODE OF ACTION OF THE HEART OF *RANA TIGRINA* DAUD.

SHARMA[1] in describing the structure of the heart of *Rana tigrina*, noted that "The study is likely to throw light on an age-old controversy about the distribution and circulation of blood in the heart and *Truncus arteriosus*". Later, he summed up: "The 'classical hypothesis' and the 'complete mixture' theory do not hold good on the basis of the above anatomical facts and the conclusion drawn is, that the systemic and the carotid arches receive the same stream from the left auricle, and if at all, there is some mixture, it is small, and this is so, perhaps when the right stream is followed by the left, which takes a longer route through the central cavity".

A perusal of the literature discloses that as early as 1933, Vandervael[2] undertook an experimental study of the blood flow in the frog's heart. He made certain direct observations and proved the fallacy of the old theory with which Sharma currently appears to differ. Foxon and Walls[3] confirmed the observations of Vandervael and conducted further experiments by injecting X-ray opaque 'Thorotrast' and discovered that the head and lungs both showed the chemical and therefore, there was no selected flow to the head. Sharma's anatomical studies now disclose that the carotid and systemic share the blood from the left auricle.

Foxon[4] also described that considerable mixture took place at the base of the conus and that there was no difference of time in the entry of blood into the three arteries. Though commenting that his anatomical observations do not agree with the old theory, Sharma appears to take us back to the 'classical hypothesis' in noting that the admixture of blood is very little and that the entry of blood into the arches is not simultaneous.

It is hoped that his fuller paper will clear up most of these contradictions.

Dept. of Zoology, L. S. RAMASWAMI.
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METASTABLE FORMS OF CORDIERITE FROM FUSED ROCKS IN INDIAN COALFIELDS

IN a recent paper, Jagapathi Naidu[1] has described in detail the optical properties of cordierites found in vitrophyres and hornfelses associated with coal seams in the Raniganj and Jharia coalfields. Venkatesh[2] has also made an excellent study of the development and growth of cordierites occurring in the para-lavas of Bokaro Coalfield.

The present note is intended to place on record immediately the important results of researches on the polymorphism of cordierite carried out by Dr. A. Miyashiro of the Geological Institute of the Tokyo University. Miyashiro[3] has already described a mineral resembling cordierite occurring in volcanic rocks, under the name *Osumilite*, and indicated that cordierites from such environments described in the literature may prove to be *osumilite*. I give below an extract from a letter received by me from Dr. Miyashiro discussing the cordierite phases found by him in specimens of fused shale from Bokaro Coalfield, sent to him by the Director, Geological Survey of India:

"In my study there exist at least four closely related polymorphic forms having cordierite composition. Among them two metastable forms were found in synthetic products only. But I considered that they may occur in some pyrometamorphic or related rocks. I was expecting that probably some of the cordierite-like crystals described by Venkatesh[2] are actually one of those metastable forms. My

expectation was justified, as all the cordierite-like crystals in the specimens of fused Bokaro shales examined by me, were one of the metastable forms.

"The most decisive distinction between the metastable form and true cordierite, lies in the fact that the space lattice of the former is hexagonal while that of the latter is pseudohexagonal. Since single crystals are not available for goniometric measurement, this difference can be demonstrated only by high precision X-ray measurements.

"Optical properties are very deceptive. The metastable forms usually show anomalous biaxial character with 2V ranging from 0-80° (I confirmed it on the grains in the fused shale). The forms sometime show very complex twin-like optical structure between crossed nicols. However, the space group of the metastable form C6/*mcc* is not compatible with twinning with twin plane corresponding to (110) and (130) as in the case of cordierite. I think that the twin-like optical structure is only an optical anomaly. As you know, lime garnet showing optical anomaly is usually divided into twin-like sectors and the form of the sectors is sometimes very complex. But this is only an optical phenomenon. X-ray measurements show that no twinning is present in the garnet. Similarly, twin-like sectors and consequent optical anomaly was proved in the case of milarite and xanthophyllite, so far as I am aware.

"Since the burning of Bokaro coal took place by natural causes the metastable form has become to fill all the conditions necessary for the strictest definition of a mineral. I am intending to call this new polymorph *Indialite* after India, for the natural occurrence is from India. This new metastable form is a very important compound in ceramic industry."

In an earlier communication Dr. Miyashiro had pointed out to me the presence of hexagonal and zoned crystals with variable 2V in the specimens of Bokaro para-lava examined by him (these may be seen in the plate and drawing accompanying Venkatesh's paper on the cordierites of para-lavas). Most of these supposed cordierite grains are, according to Miyashiro, uniaxial or biaxial, with small optic axial angles (less than 30°) and considered to be the alpha form.

According to Jagapathi Naidu, two types of cordierite are found in vitrophyres and hornfelses of the Laikdih seam at Ramnagar, Raniganj. One type is recorded to display pseudohexagonal boundaries in basal sections, with minute lamellæ parallel to these faces. These grains of cordierite are stated to be uniaxial or biaxial with small optic axial angles (below 20°). These properties are certainly different from those of normal cordierite, and these grains are presumably the metastable form *Indialite*. The second type is stated to have values of 2V ranging from 23-46°, which again is suggestive of it being one of the metastable polymorphs. The third type of cordierite described is from vitrophyres and hornfelses in the fifth seam at Jharia, and is also presumably a metastable phase though the values of 2V are higher (according to Miyashiro the values of 2V for the metastable forms range from 8-80°).

It appears to the writer that here in India, where we have occurrences of fused rocks resulting from natural burning of coal seams, *osumilite*, and the principal metastable phases of cordierite discovered by Miyashiro, will be encountered in them. Miyashiro's monograph on the polymorphism of cordierite is under publication elsewhere.* While recognising the value of the observational data presented by Venkatesh[2] and Naidu[1] in their papers, the aim of this note is to stress the importance of careful interpretation of data with the aid of X-ray studies and to focus attention on the excellent study of polymorphic transitions carried out by one of the foremost Japanese mineralogists.

My thanks are due to Dr. Miyashiro for furnishing me with his valuable data in advance of publication, and to Dr. M. S. Krishnan, Director, Geological Survey of India, for permission to present this note.

Geol. Survey of India, Madras-4, *January* 8, 1955. A. P. SUBRAMANIAM.

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* Since writing this note the paper of Miyashiro and Iiyama entitled "A Preliminary Note on a New Mineral, Indialite, Polymorphic with Cordierite" has appeared in *Proceedings of the Japan Academy*, 1954, **30** (8), 746-51.

CHROMATOGRAPHIC ANALYSIS OF SUGARS IN BANANA

THE identification of sugars in banana has interested several workers. The main sugar of ripe banana was reported by Mierau[1] to be a sucrose and this was supported by Geerlings.[2] The presence of sucrose and invert sugar was found by Yoshimura,[3] and the quantitative estimation of sucrose

glucose and fructose was carried out by Wehmer.[4] Widdowson and McCance[5] accounted the total reducing sugars of banana as the sum of glucose and fructose sugars and their observation supported the earlier work of Bailey[6] indicating the absence of maltose in the fruit. While analysing the ripe Gros Michel variety of banana, Poland and his co-workers[7] reported the presence of sucrose, glucose, fructose and small quantities of maltose. The purpose of the present communication is to report various sugars detected on paper chromatogram in the indigenous varieties of ripened and green bananas.

Fruit pulp of each variety of banana weighing 100 g. was macerated and two volumes of 80% alcohol added in each case for the extraction of sugars. The alcoholic slurry was strained through a cheese cloth and the extract centrifuged in each case. The clear extracts were made alcohol-free on a water-bath and made up to a known volume. The spots of the various extracts were made on a filter sheet and by the use of ascending paper chromatographic technique employing butanol-acetic acid-water (4 : 1 : 5) as developer and benzidine trichloracetic acid as spraying reagent, the location of various sugar spots was made. A guide strip was also run on the same chromatogram for the identification of sugar spots. The following different varieties of banana were investigated.

1. KADA BALE—*Musa balbisiana* Colla. Clone Kade bale.
2. CHANDRA BALE—*Musa sapientum* Linn. var. Chenkadali (Syn. Chandra bale).
3. CHANDRA BALE (red-coloured)—*Musa sapientum* Linn. var. Chenkadali (Syn. Chandra bale).
4. POOVAN—*Musa sapientum* Linn. var. Poovan.
5. PEYAN—*Musa sapientum* Linn. var. Peyan.
6. RASA BALE—*Musa sapientum* Linn. var. Rasthali.
7. PACHA BALE—*Musa cavendishii* Lamb. var. Pacha vazhai.
8. MADURANGA—*Musa sapientum* Linn. var. Monthan (Syn. Madhuranga bale).

An analysis of the chromatogram showed that all varieties of banana in ripened stages contain 7-8 different sugars of which 4 have been found to correspond to the positions of maltose, sucrose, glucose and fructose. Out of the remaining four spots, three of them have been located in the region lying above fructose and near about Rhamnosa. An unidentified spot below maltose has also been located.

While analysing the chromatogram for unripened fruit it was observed that sugars present were generally sucrose, glucose and fructose, but in some varieties (Kada bale and Maduranga) sucrose was found missing and in others (Chandra bale and Maduranga) fructose. Surprisingly glucose was the only sugar present in Maduranga variety. Since this is a vegetable variety which does not ripen in the normal course, it is assumd that the mechanism of starch conversion in the fruit might be different from that of the other varieties investigated. Further work is in progress to characterise the unidentified spots.

Authors thank Dr. V. Subrahmanyan for his keen interest in these investigations.

Central Food Tech. Res. Inst., Mysore, *October* 15, 1954. B. S. LULLA. D. S. JOHAR.

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5. Widdowson, E. M. and McCance, R. A., *Biochem. J.*, 1935, **29**, 151.
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A NEW VARIETY OF SUGARCANE LEAF-HOPPER *PYRILLA PERPUSILLA NIGRIVENTRIS* VAR. NOV.

DURING the course of the study on the systematic position of the three Indian forms, *viz.*, (i) winter-spring-summer form; *Pyrilla perpusilla* (Walker); (ii) monsoon-autumn-form; *Pyrilla perpusilla* var. *aberrans* (Kirby); (iii) autumn-winter form; *Pyrilla perpusilla* var. *pusana* (Distant), Mukerji and Prasad[1,2] also found in winter, a few specimens which were comparatively dark-coloured and differing in appearance from the abovementioned forms. The last mentioned specimens were, however, more or less similar to the three known forms in their genital characters. Different combinations of this dark form with the other three were released for interbreeding experiments. The new mutant paired with the ordinary forms, but no progeny could be obtained. This indicates tentatively that this form is different from the rest and might have evolved as a mutant. The cross-breeding experiment, however, needs further repetition.

This variety can easily be identified by its general darker body colouration. It appears to all intents and purposes to be a new variety so far not described. The length of the male is 4·8 mm., with wing expansion of 17·5 mm. while the female is 8·2 mm. in length, the wing expansion being 19·0 mm. Since the ventrum of this new form is comparatively of a much darker tint than the others so far known, the name *Pyrilla perpusilla nigriventris* var. nov., is provisionally proposed for it.

Ind. Agric. Res. Inst., New Delhi, *April* 12, 1954.

S. Mukerji.
V. G. Prasad.

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TWO NEW XANTHOMONAS SPECIES ON LEGUMES

Two new bacterial diseases of leguminous plants, *viz.*, *Butea frondosa* Konig. and *Tephrosia purpurea* Pers. were observed during the rainy season of 1953. This is the first record of the pathogens and each being highly specific to its own host has been allotted the status of *novum species*.

(1) *Xanthomonas buteæ* Bhatt and Patel sp. nov. incites leaf-spots on *Butea frondosa*, one of the most beautiful trees of the plains of India. In the early stage of the disease, the pathogen produces small water-soaked areas with a brown centre and pale yellow halo. Young leaves and injured tender stems are easily infected under high humidity and continuous rains so essential for the infection. With the progress of the disease, the spots increase in size to 0·8-1·2 mm., become round to angular and dark brown to jet black. The technical description of the pathogen is as follows:

Short rods, rarely in chains of two; 0·5 × 2·1 μ in size; single polar flagellum; gram negative; capsulated; agar colonies smooth, round, butyrous, raised and yellow; gelatin liquefied; starch strongly hydrolysed; casein digested; milk peptonised and litmus reduced; hydrogen sulphide and ammonia produced from peptone; acid without gas from arabinose, dextrose, lactose, sucrose and starch; no growth in salicin; no growth in synthetic nitrate and Czapeck's medium; nitrite and ammonia not produced from nitrate; optimum temperature for growth 27-30° C.; thermal death point about 51° C.; pathogenic to *Butea frondosa* only; found at Ambarnath (Kolaba), Bombay.

(2) *Xanthomonas tephrosiæ* Bhatt and Patel sp. nov. produces a few small, round, water-soaked leaf-spots measuring initially 0·5-0·7 mm. on *Tephrosia purpurea*. In the beginning, the spots are pale brown with small yellow halo around them which later increase in size to 1-2 mm. and become dark brown. The pathogen infects injured stem and rachis also. The technical description of the pathogen is as follows:

Short, single rods; 0·6 × 1·9 μ in size; single polar flagellum; gram negative; capsulated; agar colonies smooth, round, butyrous, raised and yellow; gelatin liquefied; starch hydrolysed; casein digested; milk peptonised and litmus reduced; hydrogen sulphide and ammonia produced from peptone; acid without gas from arabinose, dextrose, lactose, sucrose and starch; no growth in salicin; excellent growth in synthetic nitrate and Czapek's medium; nitrite and ammonia not produced from nitrate; optimum temperature for growth 27-30° C.; thermal death point about 51° C.; pathogenic to *Tephrosia purpurea* only; found at the Agricultural Farm, Poona.

Fuller details will be published elsewhere.

Plant Pathological Lab., Agricultural College, Poona, *October* 1, 1954.

V. V. Bhatt.
M. K. Patel.

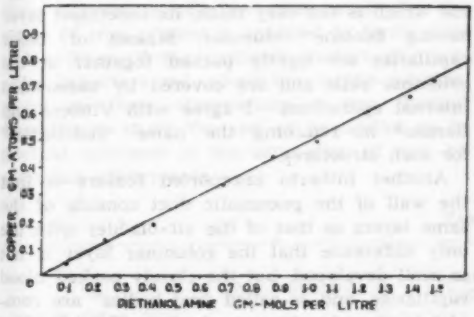
THE COMPLEX DIETHANOLAMINE COPPER HYDROXIDE

The ability of copper to form complexes with organic amines is well known. In the case of ethanolamines, although the complex triethanolamine-copper has received considerable attention, experimental data for diethanolamine are comparatively lacking.

Hieber and Levy[1] isolated the compounds $CuCl_2.2(C_2H_4OH)_2NH$ and $CuBr_2.2(C_2H_4OH)_2NH$ by reacting the copper salts with the amine in absolute methanol. It would be, however, interesting to know if any other complexes are formed in aqueous solutions, particularly as Bolling and Hall[2] have recently proposed a 1 : 1 proportion in the case of triethanolamine-copper ion complex.

May and Baker's diethanolamine containing not less than 98% total bases as $(C_2H_4OH)_2NH$ was used. Solutions of different concentrations were prepared, shaken with excess of freshly precipitated copper hydroxide, made upto volume, centrifuged to remove suspended par-

ticles, and analysed for copper. This was done by adding successively solid $MgSO_4$, dilute H_2SO_4, ammonia, acetic acid, KI, and titrating against thiosulphate. Addition of $MgSO_4$ gave a better end point, probably due to the displacement of copper from the complex. A solution of the amine with known copper content was used as a check for this procedure.



The results show that the ratio of diethanolamine to copper hydroxide is 2 : 1 in the range studied. Any intermediate complexes with ratios 3 : 1 or more, if present, cannot be detected by this method, but a complex with 1 : 1 ratio is certainly not formed. Attempts to dissolve cotton in the diethanolamine-copper hydroxide solution were not successful.

The Ahmedabad Textile Industry's Res. Assn., Ahmedabad-9,
December 20, 1954.

A. G. Chitale.
L. V. Tolani.

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CHROMOSOME RACES IN *CHRYSOPOGON MONTANUS*

Chrysopogon montanus Trin. is a perennial grass distributed in India, Ceylon and Africa and it is used as a fodder crop. The somatic chromosome number of a strain of this species is reported by Darlington and Janaki Ammal[1] to be $2n = 20$.

Six distinct strains of this plant, two from Delhi (DLH-20, DLH-21) and one each from Lahore, Simla, Nagpur and U.S.A. (E.C. 5585), are maintained here (I.A.R.I.). A study of meiosis in these strains showed that one of these strains (DLH-21) was octoploid, i.e., $n = 40$, while the other five strains had the gametic chromosome number $n = 10$ and thus those were diploids.

The octoploid strain is very easily ditinguished from the diploid strains since the former has deep green leaves, longer and more lax inflorescence and larger spikelets, florets and anthers. Fig. 1 represents a photograph showing the inflorescence of a diploid strain (DLH-20) and that of the octoploid strain (DLH-21).

FIG. 1.

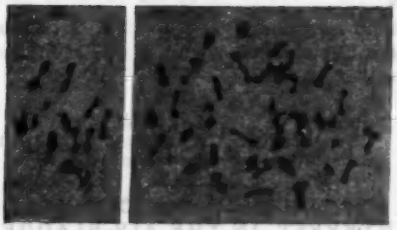

FIG. 2. FIG. 3.

FIGS. 1-3. *Chrysopogon montanus*

Fig. 1. Inflorescences of the diploid strain (left) and the octoploid strain (right) respectively.

Fig. 2. I metaphase plate of the diploid strain (DLH-20), Photomicrograph, × 800. Fig. 3. I metaphase plate of the octoploid strain (DLH-21), Photomicrograph, × 800.

Some of the salient features of meiosis, studied in two representative strains, are given below :

Diploid Strain (DLH-20).—At diakinesis and first metaphase 10 bivalents were noticed (Fig. 2). The mean chiasma frequency was 1·4 per bivalent (average of 50 plates each) at these two stages. As regards pollen fertility

97% of the pollen grains were stainable with aceto-carmine. The mean diameter of the pollen grains was $28{\cdot}4 \pm 0{\cdot}37\mu$.

Octoploid Strain (DLH-21).—At diakinesis and first metaphase a regular formation of 40 bivalents was observed (Fig. 3). The occasional precocious separation of 1-3 bivalents was noticed at I metaphase. The mean chiasma frequency was 1·5 per bivalent (average of 20 plates) at diakinesis and I metaphase. The slower movement of 4-8 chromosomes was observed at first anaphase, but in no case any lagging chromosome was seen in the cells studied at first telophase. As regards pollen fertility, 95·5% of the pollen grains were stainable with aceto-carmine. The mean diameter of the pollen grains was $46{\cdot}5 \pm 0{\cdot}7\mu$. The regular bivalent formation, absence of meiotic irregularities and high pollen fertility observed in the octoploid strain suggests that it is probably an allopolyploid.

Further studies in respect of chromosome morphology, seed fertility and crossability between the diploid and the octoploid strains are in progress.

The author's thanks are due to Drs. S. M. Sikka, A. B. Joshi and M. S. Swaminathan for kind help and suggestions during the present work.

Division of Botany, I.A.R.I., New Delhi,
December 16, 1954.

K. L. Mehra.

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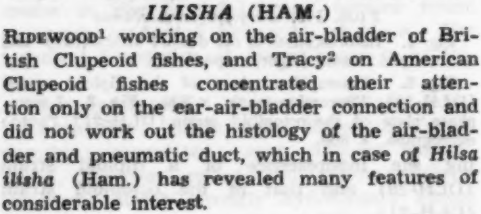
FEATURES OF HISTOLOGICAL INTEREST IN THE AIR-BLADDER AND PNEUMATIC DUCT IN *HILSA ILISHA* (HAM.)

Ridewood[1] working on the air-bladder of British Clupeoid fishes, and Tracy[2] on American Clupeoid fishes concentrated their attention only on the ear-air-bladder connection and did not work out the histology of the air-bladder and pneumatic duct, which in case of *Hilsa ilisha* (Ham.) has revealed many features of considerable interest.



Figs. 1 to 3.

As in other fishes, the wall of the air-bladder of this fish also consists of two layers: (1) tunica externa, and (2) tunica interna. The former is composed mainly of two layers, i.e., a specialized external "narcreous layer" which is very thin, and an inner muscular layer (not elastic fibres), which forms the major part of tunica externa. Such a well-developed muscular layer has not been recorded so far in the air-bladder of any other fish. The tunica interna consists of a layer of conjunctiva tissue which is not very thick, its innermost layer having become columnar. Masses of blood capillaries are tightly packed together in the columnar cells and are covered by unmodified internal epithelium. I agree with Vincent and Barnes[3] in retaining the name "red-bodies" for such structures.

Another hitherto unreported feature is that the wall of the pneumatic duct consists of the same layers as that of the air-bladder with the only difference that the columnar layer is not so well developed, but the closely packed blood capillaries, and so-called "red-bodies" are completely absent. At several places the lumen of the pneumatic duct is divided into two, and this is brought about by the formation of two septa in the inner wall of the pneumatic duct which go on developing towards each other till they meet in the middle and fuse thus completely dividing the cavity of the pneumatic duct into two (Figs. 1-3).

In due course one of the chambers enlarges at the expense of the other which gradually diminishes in size and ultimately disappears and a single cavity is left again in the pneumatic duct. Such a thing occurs three or four times, depending on the length of the pneumatic duct of the fish between the alimentary canal and the air-bladder.

The work is being continued to determine the significance of such unique division of the pneumatic duct and a detailed report will be published elsewhere. It will be worthwhile to examine other British and American Clupeoid fishes to find out if such a division is present in those fishes because this division has also been observed in *Gadusia chapra* (Ham.), another member of the Clupeidæ.

Zoology Dept., University of Allahabad,
September 16, 1954.

P. N. Srivastava.

1. Ridewood, W. E., *Jour. Anat. and Physiol.*, 1892, **26**, 26.
2. Tracy, H. C., *Jour. Morph. Philadelphia*, 1920, **33**, 439.
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PYROGALLOL AS AN INTERNAL INDICATOR IN FERROUS ION—DICHROMATE TITRATIONS

It has been found that pyrogallol, 1 : 2 : 3-$C_6H_3(OH)_3$, produces no colour with a pure ferrous salt, but a blue colour with a trace of ferric salt while a brownish red colour with a pure ferric salt. Moreover, under suitable conditions, pyrogallol when present in a solution containing ferrous ions is not oxidised by potassium dichromate solution until practically the whole of iron present is oxidised to ferric state and a trace of the oxidised product of pyrogallol imparts a red colouration to the solution. Based on these observations it was thought desirable to study the use of pyrogallol as in internal indicator in the estimation of iron by potassium dichromate.

The change was more easily perceptible if a few mls. of the titrated solution were viewed through a test-tube, 4" × ½", placed against a white tile, and it was sufficiently sharp to signify the end point. Each figure recorded in Table I is the average of duplicate determinations. The results obtained by using the proposed pyrogallol indicator are sufficiently accurate in comparison with those obtained by using previously known internal indicators.

Satisfactory results were also obtained by using hydrochloric acid in concentrations similar to those of sulphuric acid though the latter was preferable. Estimation of iron after reduction with stannous chloride and subsequent re-oxidation with dichromate was possible if this indicator was used. Ferrous gluconate could be successfully assayed by dichromate with this indicator. Stannic chloride and zinc sulphate or chloride did not interfere. The presence of orthophosphoric acid was essential. The use of pyrogallol, however, was inadmissible in presence of readily oxidisable organic matter or mercuric chloride and in residual or back titration methods.

TABLE I

Sample taken for each titration	No indicator		Diphenylamine Indicator		Diphenyl Benzidine Indicator		Pyrogallol indicator	
	0·1N $KMnO_4$	Ferrous Iron	0·1N $K_2Cr_2O_7$	Ferrous Iron	0·1N $K_2Cr_2O_7$	Ferrous Iron	0·1N $K_2Cr_2O_7$	Ferrous Iron
Strong Ferrous sulphate solution 5 c.c.	42·03 c.c.	234·5 mg.	41·62 c.c.	232·24 mg.	41·62 c.c.	232·24 mg.	41·67 c.c.	232·5 mg.
Weak Ferrous sulphate solution 10 c.c.	8·5 c.c.	49·47 mg.	8·9 c.c.	49·66 mg.	8·93 c.c.	49·84 mg.	8·87 c.c.	49·49 mg.
Reduced Ferric chloride solution 20 c.c.	5·84 c.c. Using Phosphoric acid and Manganous sulphate	32·59 mg.	5·76 c.c.	32·14 mg.			5·83 c.c.	32·53 mg.
Ferrous Gluconate 10 c.c. of 10% *w/v* aqueous solution	Ortho Phenanthroline Indicator 19·8 c.c. 0·1 N Ceric Sulphate → 109·98 mg. Ferrous Iron						20·0 c.c.	111·60 mg.

In a 250 ml. Erlenmeyer flask a mixture of 5 ml. orthophosphoric acid and 5 ml. sulphuric acid was taken with the solution to be titrated. To this 10 ml. of dilute sulphuric acid and 0·5 ml. of a 2% aqueous solution of pyrogallol were added. As the titration against decinormal dichromate proceeded no colour was developed until one-tenth of the total dichromate required was added (i.e., until $Fe^{3+}/Fe^{2+} = 1/9$), after which a pale green colour was developed which gradually became very intense and finally at the end point the greenish tinge totally vanished and a pale brownish red tinge appeared. A drop of dichromate in excess intensified the brownish red colour.

Dept. of Pharmaceutics,
Pharmacy Training Centre,
Jalpaiguri (West Bengal),
September 28, 1954.

A. B. DUTTA.

REVIEWS

Progress in Nuclear Physics, Vol. 3. Edited by O. R. Frisch. (Pergamon Press), 1953. Price 63 sh.

The present volume contains nine articles of which four deal with techniques of study such as the use of the diffusion cloud chamber, measurements with gas proportional counters, the properties of solid conduction counters, and the production of intense ion beams. The proportional counters used with a pulse analyser should prove very useful as a detector. While the resolution is inferior to that of crystal diffraction methods, the source strength required is much smaller. Solid conduction counters are only a curiosity at present and have been rarely applied, but the article in this volume may pave the way to improvements in their design and operation.

The article on Oriented Nuclear Systems deals with the production and detection of nuclei with oriented spins, a subject which is the meeting point of magnetism, spectroscopy and nuclear physics. Cerenkov radiations are discussed in their various aspects in an article of about 50 pages. These radiations are important not only because of their intrinsic interest but also by their application to the detection of cosmic ray particles in conjunction with photomultipliers. In his article on the annihilation of protons, Deutsch discusses in detail the positronium—a bound positron-electron system, analogous to the hydrogen atom. Even two modifications of this entity have been discovered *ortho-* and *para*-positroniums. There are two purely theoretical articles, one on stripping reactions and the other on the collision of deuterons with other particles.

Uniformly the articles are well written and are readily comprehensible to a non-specialist. The greatest value of this series of volumes is perhaps to such an interested reader who is not in a position to follow the recent advances from the original literature.

Physical Chemistry. By A. J. Rutgers. (Interscience Publishers), 1954. Pp. xix + 804. Price $ 8.50.

This volume is an addition to the several books of the same title now in use in different parts of the world and one that is bound to make its mark. Professor Debye remarks in his Foreword that this is a book that covers the subject completely giving the reader an impressive picture of the combination of the methods of thinking in physics and chemistry.

The volume under review is distinct in the choice of subject-matter, as well as in the manner of presentation. While the experimental background is kept in view, the treatment is essentially didactic. The extent of mathematical background that is expected of a student of the volume is such that an undergraduate in our universities may feel induced to look to some other book for his initiation. Every idea is developed fully, keeping an eye on the historical development. Wherever necessary, mathematical derivations are given in full and, once the ice is broken, the reader finds it smooth sailing. A mass of material is condensed and it is difficult to indicate any superfluous material.

The subject-matter is dealt in 35 chapters, with an additional chapter as an appendix on the physical chemistry of high polymers. The treatment, as well as the emphasis, is different from that of the usual text-books. The solid state, for instance, occupies over 6 chapters and one finds a fuller study of the symmetry properties of two- and three-dimensional structures than is usual in the common text-books of physical chemistry. Similarly, classical mechanics has a whole chapter. On the other hand, we find only the kinetic theory of osmotic pressure and not any of the other theories. While the modern theory of strong electrolytes receives a fair treatment, one looks in vain for solubility product and its analytical applications or of buffer action. Similarly in the treatment of reaction kinetics while both collision and transition state methods are considered, the reader is left to decide on the comparative merits of each approach and we find the most cursory reference to heterogeneous reactions. Diamagnetic susceptibility finds no place in the volume. The reviewer cannot help remarking on the uneven treatment of the different sections, some being quite modern, referring to recent work, while others are somewhat outmoded.

In spite of these defects the volume is well worth study and the reviewer strongly commends the book as one for reference by advanced students of physical chemistry in universities and colleges. The get-up and the

printing of the volume are up to the standard that one has come to associate with these publications.

S. V. A.

Survey of Literature on High Voltage Engineering and Allied Subjects, 1935-53, No. 1. (Memoirs of the Indian Institute of Science, Bangalore-3), (New Series). Editor-in-Chief: M. S. Thacker. 1954. Pp. 206. Price Rs. 6.

The literature references are selected first under the main subject, *viz.*, High Voltage Engineering. Allied fields such as theoretical electro-technique, fundamental theory, measuring units, electrostatics, dielectrics and such others have also been covered to make the survey useful to as many engineers and students as possible. The references under the headings and subheadings are arranged in chronological order of the publication. References under each year are arranged alphabetically authorwise. Besides the subject classification, the booklet contains an author index at the end. While the list of references cannot be considered exhaustive, there is no doubt that the present survey will be immensely useful to the young research worker in making himself acquainted with the standard and scope of literature published on special subjects.

Monomolecular Layers. (Symposium presented at the Philadelphia Meeting of the American Association for the Advancement of Science, 1951). Edited by Harry Sabotka, 1954. Pp. vii + 207. Price not given.

The volume under review consists of nine interesting articles covering a wide cross-section of recent progress in the chemistry of monomolecular layers, especially in the U.S.A. A paper on modern film techniques also describes equipment of ingenuity and sensitivity—an automatic dipping machine, a recording ellipsometer, recording film balance, etc. Articles exemplifying the application of monolayer techniques to the determination of molecular weights of proteins and mechanical properties of surface films on solutions of detergents are stimulating. With the help of the radioactive tracers the unforeseen adsorption of multiple amounts of gegenions on adsorption layers and the prodigious rate of horizontal diffusion along deposited monolayers seem to have been demonstrated. The papers dealing with radioactive tracer techniques contain valuable technical information on the application of this new tool to monolayer studies.

There is a chapter on the hydropholic monolayers and their adsorption from aqueous solution. The survey of the position on fluid-fluid outer faces studied by force-area measurements contains results of value and interest. The last two chapters describe a number of chemical reactions taking place in films and mixed films. Study of chemical reactions by surface potential measurements has elucidated the conditions which lead in several instances to a highly significant acceleration of rates in monolayers as compared to the same reactions in the bulk phase.

The volume, while supporting the importance of two-dimensional chemistry, brings out unambiguously the periphery at which physical and colloid chemistry, organic, bio- and analytical chemistry as well as chemical engineering and technology meet. The readers will find that the articles stimulate interest in a field of chemistry that has yet many unsolved riddles.

M. SANTHAPPA.

Journal of the Geological Society of Australia, Vol. I, 1953. Pp. 133.

This is the first volume of the *Journal of the Geological Society of Australia*, whose President is Prof. E. Sherbon Hills. This number consists of five articles on regional geology and tectonics. A. B. Edwards and G. Baker of the Commonwealth Scientific and Industrial Research Organization, Melbourne, have given an account of the scapolite-granulites of Cloncurry District, north-western Queensland, and the neighbouring copper mines. They compare the scapolitization to that of Kiruna District, Sweden. R. O. Brunnchweiler describes the outcrop areas of the Canning District and the Fitzroy Valley, and regards them as of Jurassic and Upper Triassic age, and not of Permian as formerly believed. He suggests that the Canning Desert area was an epicontinental shelf platform during the Mesozoic. E. Den Tex points out how the different structural components of the Kosciusko batholith may be identified and resolved in a semi-statistical manner in the Schmidt net. S. Warren Carey discusses the Rheid concept in tectonics, and examines the rheidity for various substances. He holds that the crust of the earth behaves as a solid for many tectonic processes, but that in the geosynclinal materials and orogenic zones, many fluid phenomena may occur. E. Sherbon Hills and D. E. Thomas discuss the preservation of grapolites in the Ordovician and Silurian rocks of Victoria, and hold the view that they have been

killed by fine suspended detritus in the upper parts of the turbidity currents.

The Journal has a high standard of research articles, and is worth subscribing for. Copies may be purchased of Dr. O. A. Jones, Department of Geology, University of Queensland, Brisbane.

P. R. J.

Harker's Petrology for Students, Eighth Edition. Revised by C. E. Tilley, S. R. Auckolds and M. Black. (Cambridge University Press), 1954. Pp. 283. Price 18 *sh.*

All Harker's books have been masterly presentations of the science of Petrology. His book on microscopic petrography has now run into the eighth edition, and is indicative of its great popularity and indispensability to students of Petrology. The eighth edition has even the greater distinction of having been revised by Prof. C. E. Tilley and others. The book is a fascinating and concise description of the several rock types under the microscope. Examples are taken from all over the world, and the book is thus rendered international. The revisers have added very useful references as footnotes, and students of research can go to these originals for detailed description.

In the chapter on acid plutonic rocks, no controversy is introduced on the latest theory of gravitization. The description of these rocks thus remain universal without being tied down to any theory of origin. Every student of Petrology should own a book of this kind, for it provides classical descriptions of rock types, such as one has to deal with either in going up for the Degree examination, or in conducting research.

P. R. J.

Technique of Organic Chemistry, Vol. VI. (*Micro and Semi-Micro Methods.*) Editor: A. Weissberger. By N. D. Cheronis. (Interscience Publishers, Inc., New York), 1954. Pp. 628. Price $ 12.00.

No organic laboratory can afford to be without this book, which is a most valuable addition to the literature of experimental organic chemistry, useful alike to students undergoing training in advanced organic chemistry and to research workers. Micro and semi-micro methods are of special interest for laboratories like those in our country which suffer from a chronic shortage of funds and for workers in the chemistry of plant products. The book gives a comprehensive review of available methods, but it is not a mere literature survey. For a given type of preparation or analysis, the methods are critically assessed, and recommended procedures are described with complete experimental details. The necessary apparatus is also described in detail with the aid of clearly drawn diagrams.

After a brief introduction explaining the applications and advantages of microtechniques, the book is divided into three parts dealing with general methods, preparations, and analytical procedures. Part I provides the background for applying micromethods to problems of preparation, identification, characterization and analysis in organic chemistry; it gives an account of micromethods of crystallization, distillation, sublimation, extraction, measurements of physical constants, and miscellaneous operations and tools. Micropreparations involving reduction, oxidation, halogenation and other unit processes of organic synthesis are described in Part II, which concludes with a chapter (by Dr. A. R. Ronzio) dealing with the special techniques and precautions used in microsyntheses with tracer elements. Microanalysis of elements, adequately covered in the books of Niederl, Pregl and others, has been rightly excluded from Part III, which discusses with a wealth of practical detail micromethods for characterization, functional group tests, and preparation of derivatives (for which the cumbrous new verb, derivatization, is used). The least satisfactory chapter is Chapter XVII in Part III, written in collaboration with Professor T. S. Ma and consisting largely of a tabular statement of the "present status of microprocedures for functional group analysis".

K. V.

Advances in Enzymology, Vol. 15. Edited by F. F. Nord. (Interscience Publishers, Inc.), 1954. Pp. x + 547. Price $ 11.00.

The latest volume in this series contains a useful collection of reviews on topics ranging from mechanism of enzyme action to the minutial of intermediate metabolism. The international flavour so characteristic of "Advances in Enzymology" is clearly discernible in the volume. Of the eleven contributions, four are from America, two from England, one from France, one from Japan, two from Australia and one from Germany.

In the first chapter Leach gives an account of the work done towards the elucidation of the "Micromechanism" of biocatalysis in oxidation-reduction reaction with particular emphasis on the use of enzyme models and on the prob-

lem of free radical formation. The author points out in his discussion that the kinetic approach to the problem will pave the way for a fuller understanding of mechanisms in the field. Wurmser has discussed the thermodynamics of immunological reactions. A brief summary of the various theories proposed to explain the action of hydrolytic enzymes is given by Lindley. In the critical and provocative article, the pitfalls in the kinetic approach employed in the study of enzyme action are taken cognizance of and the lacunæ in the various theories indicated.

Two chapters are devoted to a discussion of the recent advances in carbohydrate metabolism. While appreciating the importance of isotopic studies, the part played by inhibitors such as fluoride and iodoacetate in the elucidation of the glycolytic pathway and the analytical methods of the enzymologist in studying the separate reactions as a prelude to the investigation of the over-all mechanism of cellular metabolism. Racker sounds a note of warning against undue generalisation and advocates a pooling of information obtained by the use of different techniques before enunciating alternative pathways of carbohydrate metabolism. Stacey's article provides a concise and readable survey of recent work on the biosynthesis of polysaccharides which was greatly facilitated by employing chromatographic techniques and by the use of labelled sugar molecules.

The article of Ochoa on the "Enzymic Mechanisms in the Citric Acid Cycle" and another by Ratner on "Urea Synthesis and Metabolism of Arginine and Citrulline" are outstanding. These two contributions together present a rich harvest of results obtained by recent researches which followed the trail blazed by the pioneer biochemist, H. A. Krebs.

Singer and Kearney contribute a lucid and comprehensive review on pyridine nucleotide co-enzymes laying stress on their chemistry and scope of action. The discussion brings into sharp focus the diverse metabolic processes mediated by the pyridine nucleotide components of the cell. The enzymic reactions in which the role of pyridine nucleotide catalysis is proved beyond doubt, are summarised in a tabular form.

The thiaminases and the complex nature of the antithiamine factor in ferns has been discussed by Fujita with remarkable clarity.

Other contributions include "Rennin and the Clotting of Milk" by Berridge and "The Structure of Tobacco Mosaic Virus and Their Mutants" by Schramm in German. Although the style and scope of the various articles show great diversity, the reviewer was impressed by the stimulating tenor of most of the discussions. The Editor should be congratulated for the commendable discretion with which he has collected in one volume highly informative reviews on the manifold aspects of enzymology written by recognised authorities.

The book is free from glaring mistakes. However, the structural formula given to malic acid in page 300 is incorrect and this appears to have been overlooked.

K. V. Giri.

Recent Progress in Hormone Research, Vol. X. (*Proceedings of the Laurentian Hormone Conference.*) Edited by Gregory Pincus. (Academic Press, Inc.), 1954. Pp. 511. Illustrated. Price $ 9.80.

An account is given in the volume under review, of the proceedings of the Tenth Annual Meeting of the Laurentian Hormone Conference held at Ottawa in September 1953. As in previous volumes, the papers which were read at the Conference along with *verbatim* record of informal discussions have been printed in this volume.

There are six main sections: (*i*) nervous system: hormone interrelationships; (*ii*) thyroid hormone: physiology and biochemistry; (*iii*) comparative indocrinology; (*iv*) protein hormones; (*v*) the role of hormones in blood and blood-forming organs; and (*vi*) aspects of clinical indocrinology, with two or three research papers in every section. The scope and variety of papers are such that besides the endocrinologist, the pharmaceutical chemist, biochemist, clinician or the medical research worker will find in them matter of absorbing interest. Thus the salt alcohol extraction technique and crystallisation methods discussed in detail by Romans will be of value to the pharmaceutical chemist, while the discussion on the homogeneity of insulin along with the comments on the structure of insulin molecule will benefit the biochemist. The three papers in the section on nervous system: hormone interrelationships deal mainly with the relations which exist between adrenal cortex and various areas of the central nervous system. Porter, in one of the articles, clearly brings out the role of hypothalmus in the pituitary-adrenal co-ordination. The role of adrenal steroids on nerve function is similarly discussed at length by Hoagland.

Gross and Pitt-Rivers give in another section, a lucid account of their investigations on

triiodothyromin in relation to thyroid physiology. The fact that this newly-discovered compound is 5-10 times more active than thyroxine has led to considerable speculation in regard to its biogenesis and its role as the peripheral hormone of the thyroid gland. Their paper along with that of Lardy and Maley, in which the theory is proposed that thyroxine regulates metabolic rates by varying the efficiency with which cellular oxidations are coupled with phosphorylations, bring once again the investigations on thyroid gland to the forefront of hormone research.

Research work on endocrine mechanisms in insects has received a fresh impetus through the investigations of Bodenstein. The hormones secreted by specialised nerve cells are dealt with in great detail by Scharrer and Scharrer, while the relationships between thymus, œstrogens and lymphoid tumours have been studied by Kaplan and his colleagues. Gordon has presented evidence to show that endocrine glands participate in hemopoietic and blood-destroying processes. Zondek's paper on some problems relating to ovarian function, though strictly not a recent advance will, nevertheless, be of considerable interest to clinicians and research workers. The chemistry of corticotropins, their influence on electrolytic and fluid metabolism and also on stress states have been discussed at length and in the reviewer's opinion, will be of immense value to physicians and physiologists alike. The present publication is undoubtedly, a very valuable addition to the existing literature on recent progress in the field of endocrinology.

V. Srinivasan.
P. S. Sarma.

Chromatography. (*British Medical Bulletin*, Vol. 10, No. 3), 1954. Price Rs. 12-3-0. (Copies can be had from: Oxford University Press, Madras-2.)

Several publications on chromatography have appeared in recent years, but the one under review is of special interest to the medical profession. For, in addition to giving a general idea of the scope of chromatography, this Bulletin also shows how this recently developed technique can be of service to medicine either directly or indirectly. Starting with a general introduction by A. J. P. Martin, the veteran in this field, one finds that the general principles of chromatography are discussed by R. J. P. Williams. Then follow a number of articles on gas liquid chromatography, practical aspects of chromatography, chromatography of organic acids, peptides, inorganic elements, carbohydrates, phosphoric esters, porphyrins, nucleotides, thyroid hormones, antibiotics, vitamins, sterols and proteins, written by specialists in the respective fields. The concluding chapters are on the separation of amino acids and lower peptides by displacement chromatography by the use of ion exchange resins and on amino acid metabolism.

Commendable features in every chapter are the many instructive graphs tabulated data and up-to-date references to literature. Besides, the volume has some excellent photographs on the types of equipment used in chromatography and on the separation of amino acids from normal human plasma, sweat, urine, uribrospinal fluid and biological fluids obtained from certain definite types of clinical cases. In short, this special Bulletin is a mine of information on chromatography as applied to medicine, and should appeal particularly to those who are engaged in medical and biological research.

P. S. Sarma.

The Biochemistry of Semen. By T. Mann. (Methuen, London), 1954. Pp. xiv + 240. Price 16 *sh.*

Ever since artificial insemination has come to be accepted as a method of breeding in farm animals, the scientific study of semen properties has obviously become important. Within a short period, therefore, a considerable amount of research work on the histology of spermatozoa, physicochemical properties of semen, effect of extraneous factors on the viability of the spermatozoa, etc., have been carried out and a vast literature on the subject has grown up. Mann's monograph on "The Biochemistry of Semen", though it deals only with one aspect of seminology, is a step in the right direction and is very welcome.

The author is well known for his researches on the biochemistry of semen. His discovery of the presence of fructose as glycolysable sugar in seminal plasma and the evolution of "Fructolysis index" as a method of appraisal for sperm metabolism and activity stand out prominently as notable contributions to the study of semen.

The monograph is divided into 9 chapters. They serially deal with the two semen components, *viz.*, the spermatozoa and the seminal plasma; their physico-chemical properties; the influence of various extraneous factors, *viz.*, sperm inhibitors, spermicidal substances, short wave radiations, semen dilutors, deep freezing, etc., on sperm viability; the enzymes and proteins of semen plasma and spermatozoa respec-

tively; metabolic processes; and the effect of various chemical identities present in semen, viz., lipids, fructose, citric acid; inositol and some of the nitrogenous bases, on the metabolism of the spermatozoa.

In Chapter II the author has, among other subjects, discussed briefly the methods of evaluating semen quality. It is felt, however, that if he had dealt with this subject in greater detail in a separate chapter (as he has done for fructolysis, citric acid, inositol), the monograph would have a wider usefulness not only among persons concerned with artificial insemination of domesticated animals, but also among those concerned with the clinical diagnosis of human infertility.

P. BHATTACHARYA.

The Structures and Reactions of the Aromatic Compounds. By G. M. Badger. (Cambridge University Press.) Pp. xii + 456. Price 63 *sh.*

The book provides an excellent correlation between the numerous facts and theories concerning the chemistry of aromatic compounds and as such, is a definite contribution to our understanding of aromaticity.

The chapters numbering eleven cover a wide range of aromatic chemistry and are written in a clear and logical manner. The first two chapters deal with the 'Benzene Problem' and its theoretical solution in terms of wave mechanics respectively. The treatment which is non-mathematical in nature will aid distinctly the chemist disinclined to mathematics to have a better understanding of π and σ bonds. The subsequent chapters present a number of critically selected reactions and properties of aromatic compounds, and discuss their theoretical explanation. Of necessity, some of the less important reactions have been left out of discussion which, however, is by no means superficial.

The book ought to provide stimulating and valuable reading to chemists wishing to keep in touch with the latest developments.

S. SWAMINATHAN.

Books Received

Glutathione (Proceedings of the Symposium held at Ridgefield, Connecticut, November 1953). (Academic Press), 1954. Pp. x + 341. Price $ 7.50.

Chapters in Physical Chemistry. By B. N. Phadke. (Dastane Brothers' Home Service, Poona-2), 1954. Pp. vii + 667. Price Rs. 14.

Chemical Pathways of Metabolism, Vol. I. Edited by D. M. Greenberg. (Academic Press), 1954. Pp. x + 460. Price $ 11.0.

The Theory of Cohesion. By M. A. Jaswon. (Pergoman Press, London), 1954. Pp. viii + 245. Price 37 *sh.* 6 *d.*

Some Beautiful Indian Climbers and Shrubs. By Borr and Raizada. (The Bombay Natural History Society, Bombay), 1954. Pp. viii + 286. Price Rs. 22.

The Production and Use of Power Alcohol in Asia and the Far East. (Report of a Seminar held at Lucknow), 1952. (Published by the Economic Commission for Asia and the Far East, United Nations, New York), 1954. Pp. 445. Price not given.

Introduction to Theoretical Organic Chemistry. By P. H. Hermans. Edited and revised by R. E. Reeves. (Elsevier Pub.), 1954. Pp. xii + 507. Price 38 *sh.* 6 *d.*

Introduction to Atomic and Nuclear Physics. Third Edition. By Henry Semat. (Chapman & Hall), 1954. Pp. xii + 561. Price 50 *sh.*

The Testing of High Speed Internal Combustion Engines. By Arthur W. Judge. (Chapman & Hall), 1955. Pp. xvi + 494. Price 75 *sh.*

Squaring the Circle and Other Monographs. By E. W. Hobson. (Chelsea Publishing Co.), 1953. Pp. 361. Price not given.

Irrigation and Hydraulic Design. By Serve Leliavsky. (Chapman & Hall), 1955. Pp. xii + 492. Price 126 *sh.*

The Lipids—Their Chemistry and Biochemistry, Vol. II. By Harry J. Deuel Jr. (Interscience Publishers, Inc.), 1955. Pp. xxvi + 919. Price $ 25.00.

PEACEFUL USES OF ATOMIC ENERGY

INVITATIONS to take part in the International Conference on the Peaceful Use of Atomic Energy which is to open at Geneva on August 8 have been issued to the 60 member States of the organization and to 25 non-member States who are connected with the specialized agencies. The Conference is expected to last 12 days. Dr. H. J. Bhabha (who was a member of the Advisory Committee) has been named as President of the Conference. Its Secretary-General will be Professor Walter Whitman, of the Massachussetts Institute of Technology.

SCIENCE NOTES AND NEWS

Male Gametophyte in Cultivated Jute

Shri R. M. Datta, Cytogenetics Department, Jute Agricultural Research Institute, Barrackpore, writes as follows: While studying the development of the male gametophyte in the two species of cultivated jute (*C. olitorius* Linn. and *C. capsularis* Linn.) for the last four seasons, the author came across only five pollen tubes in *C. olitorius* containing three sperms each, instead of the normal two.

Bonemeal and Hypophysectomized Male Toad

In continuation of a previous report in this Journal (*Current Science*, 1952, 21, 345), Mrs. K. Harris, Department of Biology, Madras Veterinary College, Madras, states that studies made with hypophysectomized male toad show that bone-meal extract can produce the emission of sperms even in the absence of the pituitary body.

International Congress of Neuropathology, 1955

The Second International Congress of Neuropathology will be held at the Royal College of Surgeons, Lincoln's Inn Fields, London, from 12th to 17th September 1955. Those desirous of attending the Congress and/or presenting papers are requested to communicate with Dr. V. R. Khanolkar, Director, Indian Cancer Research Centre, Chairman of the International Committee on Neuropathology for India, on the above address before 15th April 1955.

Symposium on the Chemistry of Pyrones

A symposium on "Recent Advances in the Chemsitry of Naturally Occurring Pyrones and Related Compounds" will be held in the Department of Chemistry, University College, Dublin, on July 12-14, 1955. The following have accepted invitations to participate: Dr. R. G. R. Bacon (Belfast); Professor W. Baker, F.R.S. (Bristol); Dr. E. C. Bate-Smith (Cambridge); Professor H. Erdtman (Stockholm); Professor K. Freudenberg (Heidelberg); Porfessor S. Hattori (Tokyo); Professor F. E. King, F.R.S. (Nottingham); Dr. W. D. Ollis (Bristol); Professor H. Schmid (Zürich); Professor T. R. Seshadri (Delhi); Dr. T. H. Simpson (Aberdeen); Professor K. Venkataraman (Bombay); Dr. W. B. Whalley (Liverpool); Dr. G. Woker (Berne).

Those wishing to attend this symposium are requested to communicate with Dr. Eva M. Philbin, Department of Chemistry, University College, Dublin. The registration fee is ten shillings. The programme will be sent to those registered.

Endeavour Prizes

The Imperial Chemical Industries (Publishers of the quarterly scientific review *Endeavour*) have offered the sum of 100 guineas to be awarded as prizes for essays submitted on a scientific subject. The competition is restricted to those whose twenty-fifth birthday falls on or after 1st June 1955. The subjects for the essays are as follows: The Earth's Magnetism, Man-Made Fibres, Climatic Changes, Scientific Aids to Food Supply, Respiration, New Metals for Engineers. The essays, which must be in English and typewritten, should not exceed 4,000 words in length, and only one entry is permitted from each competitor. Essays must be submitted without signature. The competitor's full name and address and date of birth should be disclosed in a sealed covering letter attached to the essay and addressed to: The Assistant Secretary, British Association for the Advancement of Science, Burlington House, Piccadilly, London, W.1, and must be received before June 1, 1955.

German Scholarships

The German Federal Government has offered Indian nationals four scholarships for postgraduate or doctorate studies in West German and West Berlin Universities for 12 months with effect from November 1, 1955.

The amount of scholarship is DM 250 (equivalent to about Rs. 280 p.m.) in addition to free studentship at the University. Travelling expenses from the German border to the University town and back will be paid. Candidates will be responsible for cost of passage from India to Germany and back. Candidates possessing First Class Master's Degree with good academic record, having command over the German language and below the age of 27 years on November 1, 1955, will be eligible.

Effects of Flying on Patients with Cardiovascular Disease

The enormous increase in air travel during recent years has, among other results, led to the necessity of considering its effects upon passengers suffering from organic disease. The physical standards insisted upon by Government services and by private air lines in the selection of pilots and air crews of all sorts are naturally very high. This attitude has perhaps led to the parallel conclusion that none but physically fit individuals can safely be subjected, as passengers, to the strains and stresses of this form of transport.

But according to the figures obtained from a recent survey carried out by Medical Committee of the International Air Transport Association from 13 different air lines, one cardiac death has occurred per 1,113,000 passengers carried, or per 800,000,000 passenger miles, on a five-year average.

Also examples from many different varieties of cases of organic heart disease would seem to show that flying is perfectly safe when the heart is well compensated, and that it is a reasonable risk in patients whose state of compensation is not perfect, provided that the journey is necessary, or provided it is of such personal importance to the patient that he is prepared to take what can accurately be described as a very moderate risk. Generalizations as to suitability or unsuitability for flying cannot be made. Every case must be considered on its merits. (*British Medical Journal*, 1955, Feb. 5, p. 311.)

Tracer Research Unit, NCL, Poona

The need for setting up a radioactive tracer laboratory at the N.C.L., Poona, was recognised early in 1953, and in October of that year, Dr. R. Scott Russell of Oxford University was invited to initiate the setting up of the laboratory. Dr. Scott Russell visited the laboratory again last December-January to advise on the tracer research programme and to check the safety precautions in regard to health hazards.

The tracer laboratory includes provision for installing a 100 mc. radium-beryllium neutron source. Due stress has been laid on health precautions. The laboratory is well equipped to undertake a wide range of radioactive assays and for autoradiographic work. So far, five shipments of radioactive isotopes have been obtained from the Atomic Energy Research Establishment in Harwell. Some ancillary components of the counting equipment have also been constructed in the laboratory.

Progress of Metallurgical Research

Circulars are being issued by the Metals Research Committee of the Board of Scientific and Industrial Research to all institutions and agencies conducting research in metallurgical field, with a view to gather information on the progress of the researches.

It is not the intention of the Committee to get detailed information of any research of a secret nature that is being pursued, particularly in the private sector. In order to protect the research workers' interest and to encourage fullest co-operation of all the national laboratories, universities, educational institutions and other bodies, information is requested on broad lines on the titles, aims, scope and progress of the work on hand or contemplated to be taken up in the near future.

Hg-Th Alloy for Low Temperature Thermometers

While mercury freezes at — 38° C., a mercury-thallium alloy with similar properties freezes at — 58° C. Used in thermometers this alloy presents various technical problems during manufacture but these have been overcome by H. J. Elliott, Ltd., U.K., who now produce this type of instrument. As a result, temperatures between — 38° C. and — 58° C. can be measured without reliance on a spirit such as alcohol, pentane or toluene which, in a large bore, gives accuracy no more than to the nearest tenth of a degree centigrade. Thermometers using the mercury thallium alloy are therefore specially suitable for the same purposes as low temperature kinematic viscosity thermometers.

Advances in Cancer Research

Some of the major gains in cancer treatment and research made wholly or partly at the Memorial Centre for Cancer and Allied Diseases, New York, in recent years have been reviewed in their biennial report. These are: (i) for the first time sustained growth in massive quantities of human cancers in laboratory animals have been achieved. This enables researchers to work on a large scale hitherto impossible; (ii) over two decades, the cure rate for cancers of soft tissues of the type called "sarcomas" has risen from 6% to 39·5%; (iii) 6 mercaptopurine (synthesised by the Welcome Research Laboratories) has proved to be the most effective agent yet in restraining acute leukæmia; (iv) over the years, the number of patients with cancer of the stomach who can be treated surgically has risen from 10% to 75%; (v) surgical techniques have been

improved so that liver cancer can be treated by surgery on this vital organ; (*vi*) viruses have been adapted to destroy, rapidly and completely, human cancer cells of one type in the test-tube.

Ultrasonic Tanning

Australian scientists have demonstrated that calfskin pelts can be converted into leather by brief exposures to ultrasonic radiation while in the tanning bath. With vegetable tanning extracts the process is complete in from 1-3 hours. (Conventional tanning may take from 6-10 weeks.) With synthetic tanning liquors, results are even better. Chrome tannage with ultrasonic irradiation is more uniform but not much more rapid, probably because of the smallness of the colloidal particles.

This achievement, reported by R. L. Ernst and F. Gutmann, of the New South Wales University of Technology, is experimental and was carried out with a vibrating quartz crystal. Transducers and a continuous method of extracting heat generated in the process will be necessary before the economic importance of the discovery can be assessed.

Institution of Chemists (India) Associateship Examination, 1955

The Fifth Associateship Examination of the Institution of Chemists (India), will be held in November 1955. The last date for receiving applications from the intending candidates is 31st July 1955. The Examination in Group A (Analytical Chemistry) is divided into the following nine sections and the candidates will be examined in any two of them according to their choice, in addition to General Chemistry including Organic, Inorganic, Physical and Applied Analytical Chemistry—(1) Analysis of Minerals, Silicates, Ores and Alloys, (2) Analysis of Drugs and Pharmaceuticals, (3) Analysis of Foods, (4) Analysis of Water and Sewage, (5) Biochemical Analysis, (6) Analysis of Oils, Fats and Soaps, (7) Fuel and Gas Analysis, (8) Analysis of Soils and Fertilisers, and (9) Analysis connected with Forensic Chemistry.

Candidates registering their names as examinees *by the 30th April* 1955, will be entitled to avail of the Tutorial Classes.

Further enquiries may be made to the Honorary Secretaries, Institution of Chemists (India), Chemical Department, Medical College, Calcutta-12.

Indian Council of Ecological Research

With a view to promote and expand ecological studies on Indian vegetation, an Indian Council of Ecological Research has been recently set up with the following members:

Chairman: Shri C. R. Ranganathan, New Delhi; *Vice-Chairmen*: Shri K. L. Aggarwal, Dehra Dun; Fr. Santapau, Calcutta; *Members*: Dr. R. K. Saksena, Allahabad; Dr. S. L. Hora, Calcutta; Dr. J. K. Basu, New Delhi; Shri A. C. Joshi, Chandigarh; Dr. R. Misra, Saugor; Dr. L. A. Ramdas, Poona; Dr. S. P. Ray Choudhuri, New Delhi; Shri Salim Ali, Bombay; Dr. S. Sinha, Agra; Shri M. M. Srinivasan, Dehra Dun; Shri S. K. Seth, Naini Tal; Shri K. N. Kaul, Lucknow; *Secretary*: Dr. G. S. Puri, Dehra Dun.

The Council is expected to meet at the Forest Research Institute, Dehra Dun, sometime in 1955 to chalk out plans for the execution of ecological studies in relation to forestry, agriculture, desert control, soil conservation, flood control, etc. All interested in ecological research are requested to get into touch with the Secretary, Indian Council of Ecological Research, P.O. New Forest, Dehra Dun (U.P.), for further information regarding the co-ordinated programme of the Council.

Exchange of Medical Publications through WHO

Medical libraries throughout the world, which previously offered their surplus publications to other medical institutions for free distribution and exchange through UNESCO, will now offer them through the WHO Headquarters in Geneva. It will not itself collect and make shipments of such material, but will act as a central information service for medical libraries wishing to exchange and distribute material. All shipments of publications will be made directly from one medical library to another, after agreement has been reached on the exact items required and on the question of transport costs.

Award of Research Degree

The Gujerat University has awarded the Ph.D. Degree in Chemistry to Sri. C. C. Patel for his thesis entitled "Studies in Chalkones and Related Compounds", and to Sri. V. T. Oza for his thesis entitled "Some Reactions of Hyponitrites and Nitrites".

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